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# SUPPLEMENT.


# The Mining Journal,

## RAILWAY AND COMMERCIAL GAZETTE:

**FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.**

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## Original Correspondence.

### COLLIERIES IN NORTH DURHAM, THEIR WORKINGS AND MACHINERY—No. XIII.

West Stanley Colliery.—This property was leased in May, 1842, by Messrs. David Burn and partners from Col. Townley; its area is under 400 acres. The lease is now held solely by Mr. Burn, whose engineer is Mr. A. Winship. Six pits existed on the property prior to the re-opening of the mines by the company. These had lain dormant about 70 years anterior to the date of the lease. The causes which led to their abandonment were probably the opening of collieries nearer the rivers Tyne and Wear, producing a stronger quality of coal than that in the Tanfield and Stanley district, the heavy leading charges from this remote district, and the finishing of the Five-quarter seam. The date of the commencement of coal working in West Stanley property would probably be before the year 1700. From three seams available the working seems to have been confined to the Five-quarter and Main Coal seams; the Five-quarter coal in particular has been much sought after. It is understood to have been got after the manner of ancient mining, by taking about one-half of the coal and leaving one-half in pillars; the latter may at some future day be worked, though the regaining them will involve additional outlay. The Shield-row seam lies above the Five-quarter, but it is comparatively little worked, its quality not suiting the requirements of those days. Coal was raised in the pits at this early period by horses and gins. The quantity of water that could be raised by this means was very limited, but provision had been made in the first place for the drainage of an extensive district by driving a main adit, which commences near Beamish forge, and passes through the Beamish, West Stanley, and Oxhill properties. This adit is driven water-level in the Main Coal seam; its length is about two miles up to West Stanley, and is extended about one mile further to Oxhill property, draining by means of cross levels and boreholes a number of mines, principally in the Five-quarter seam, in its route. It is still used as a water-course, and is a remarkable specimen of workmanship of the mining of that period. Its height is from 4 ft. 6 in. to 4 ft. 10 in., the height of the Main Coal; its breadth not more than 2 ft., cleanly cut at both sides, with a groove formed in one side, about 8 in. square, which has been enclosed, and formed the only passage for the ingress of air to the face. The six pits referred to were mostly sunk to the Five-quarter seam only, a cross level being driven under each pit from the main adit, and a borehole from the Five-quarter put down to the cross level in the Main Coal. The pits could not have been sunk otherwise in those days, as some considerable feeders of water are found in sinking to the Main Coal. Coal was conveyed from these pits at the early period by horse traction, on a wooden railway, forming a junction with the Beamish Railway, by which it was conveyed to Fatfield staiths, where, being shipped into keels, it was taken to Sunderland for transshipment into vessels engaged in the London trade.

Three of the old pits have been enlarged, and deepened in two cases, since the re-opening of the mines, 28 years ago. A new lease has been given to the life of this district, consequent on the demand for the quality of coal it produces for the manufacture of gas, and also on the formation of the Stanhope and Tyne Railway, which passes near to the West Stanley pits. These pits are situated at the surface, at an elevation of 740 ft. above the sea. A winding-engine is erected at each, with heapstead, screens, and pulley framing of wood.

The Fanny Pit is a downcast, 11 ft. in diameter, 40 fms. in depth, to the Shield Row seam. Re-opened fours years ago; was sunk previously to the Main Coal seam; filled up now to Shield Row seam. Horizontal winding-engine, with one 15-in. cylinder, 2 ft. 4 in. stroke, and fly-wheel; pinion 2 ft., spur-wheel 6 ft. 4 in., cylindrical drum 6 ft. 4 in. in diameter. Two plain boilers, 23 by 4½ ft., 23 by 5 ft., not covered, flash flued; 30 lbs. steam pressure. About 250 tons of coal per day is raised from the Shield Row seam, with single-tub cages; depth, 40 fms. This engine lifts water also about seven hours each night from the same seam, by tanks holding 150 gallons each, one of which is placed in each cage. The tanks are self-filling and self-delivering, at bottom and top. There are four single coal screens at this pit.

The Kettledrum Pit.—Re-opened in 1860; also a downcast, 11 ft. in diameter, 105 fms. in depth to the Hutton seam. Beam winding-engine, 38½-in. cylinder, 6-ft. stroke, 15-ft. cylindrical drum, and fly-wheel. Two plain boilers, 30 by 6 ft., uncovered, flash-flued, 30 lbs. steam pressure. Each boiler is fitted with two safety-valves, two common floats, and one sludger. The water raised from the Hutton seam is used for the boilers, which is excellent for its purpose, containing a large percentage of soda. About 340 tons of coal raised per day, in equal proportions, from the Low Main and Hutton seams; the whole is raised by the engine from the Hutton seam level (105 fms.), with two-decked cages, two 8-cwt. tubs in each cage. The coal of the Low Main is dropped down by a staple, 4 fathoms in depth, to the Hutton seam. Water is raised by the winding-engine for about seven hours each night from the Hutton seam, in 150-gallon self-acting tanks; one is placed in the lower deck of each cage. There are six coal screens at this establishment. The pit is walled only to the stone head; 15 fms. of cast-iron tubbing is inserted at and above the main coal seam, to exclude the water that would accumulate in the working of that seam, in the event of the adit becoming stopped up.

The Lamp Pit is about 200 yards distant from the Kittledrum Pit, re-opened 28 years ago, is 11 ft. in diameter, 100 fms. in depth to the Hutton seam. This is the agent for the ventilation of the whole of the mines by its heated column, and a furnace hitherto placed in the Low Main Seam. There is 15 fms. of cast-iron tubbing in this pit also, to serve a similar purpose to the other at the Main Coal seam. The pit has been walled to the stone head only. Until recently coal has been raised from the Shield Row seam; this is now suspended in order to build a furnace in the Hutton seam to replace the old one, and to insert a casing of fire-brick the entire depth of the pit (100 fms.); the bricks are 16 in. wide in the circle of the pit, 4 in. deep, and 8 in. in the bed. This will also serve to protect the tubbing from the action of heated noxious vapours; the diameter of the pit will thus be reduced to 9 ft. 8 in. Lever, non-condensing winding-engine, made at Messrs. Rayne and Burns' works, with 32-in. cylinder, 5-ft. stroke, 10-ft. cylindrical drum; fly-wheel, 60 ft. in circumference, with foot-break, acting on the under half of it. Two plain boilers, 28 by 7 ft., uncovered, flash-flued, supply steam at 20 lbs. pressure. The whole of the pit ropes and chains are examined thoroughly daily by the colliery engineer; the rule here is, if one wire of a rope is worn through to replace it by a new rope. The usual duration of the pit ropes is 18 months. It speaks strongly as to the attention given to this subject that no accident has occurred from the breaking of ropes, nor from over-winding, though there is no special appliance to prevent this. After adopting every improvement, whether this is with a view to prevent shaft accidents or explosions, it is only by the exercise of human care and forethought, conjointly with such improvements, that these accidents can be avoided, and we must acknowledge some credit is due to those engaged in the operations of raising coal in the pits of the northern coal field.

Underground Workings.—There are five recognised seams at West Stanley Colliery—1. The Shield Row seam.—2. The Five-Quarter.—3. The Main Coal or Brass Hill.—4. The Low Main.—5. The Hutton seam. The Maudlin seam is irregular, and only occasionally found; its place would be after No. 3. By sinking below the Hutton seam two other good seams will, in all probability, be found to exist. The sections of the above seams are as follows:—

| | | Thickness. | | Depth. |
|---|---|---|---|---|
| 1.—The Shield Row Seam | 1. Top coal | 1 ft. 10 in. | | |
| | 2. Inferior fire-clay.. | 0 6 | | Fms. |
| | 3. Coal | 2 10=5 ft. 2 in. | | 40 |
| | 4. Badger | 0 6 | 1 10 | not taken away. |
| | 5. Coarse coal | 1 4 | | |
| | 6. Inferior fire-clay. | | | |
| | Blue metal roof. | | | |
| 2.—Five-quarter Seam .. | 1. Good coal | 3 6 | | |
| | 2. Splint | 0 4=3 10 | | 49 |
| | 3. Inferior fire-clay. | | | |
| | Blue metal roof. | | | |
| 3.—Main Coal, or Brass-thill Seam | 1. Clean coal | 4 8 | | 60 |
| | 2. Inferior fire-clay. | | | |
| 4.—The Low Main Seam (South District). | 1. Coal | 1 10 | | |
| | 2. Splint | 0 1 | | |
| | 3. Coal | 1 4 | | |
| | 4. Grey metal band. | 0 2 | | |
| | 5. Coal | 1 3=4 8 | | 96 |

In the northern part of the property there is 2 feet of coal above the section as given of No. 4, with 8 inches of black shale between; this coal is supposed to be the Maudlin seam, which in the Tanfield district unites with the Low Main, and is there as one coal named the Hutton Seam.

| | | | | |
|---|---|---|---|---|
| | Blue metal roof. | | | Fms. |
| 5.—The Hutton Seam (of Wear) | 1. Clean coal | 3 ft. 6 in. | | 100 |
| | 2. Inferior fire-clay. | 0 10 | | |
| | 3. Soft metal | 4 0 | | |

The coal measures lie nearly level here—a slight rise to west, if any. The cleavage runs north and south. Coal is got altogether on the bord and pillar system. In the Shield Row seam the pillars are made 40 by 12 yards; bords 4, walls 2 yards wide. The pillars are taken away by driving 5-yard lifts westward, 10 yards in length. Candles are used both in whole and pillar workings. In the Hutton seam the pillars have formerly been made 30 by 12 yards, they are now made 22 yards square; bords 4, walls 2 yards wide. The pillars are removed by driving a narrow jenkin westward in the middle of each pillar, and 5-yard lifts on each side from that. Candles are used in whole, Davy lamps in pillar workings. This seam produces fire-damp in a slight degree. No powder is used for coal-getting. The coal is tender, with a soft bottom, which soon heaves or creeps in the vicinity of a goaf, requiring several strong pillars to protect the wagon or other roads. The bords are usually driven in sets of 12, both west and east, six on each side of the wagon road; when driven to their full extent the pillars are worked back homewards. In the Low Main seam the pillars are made of the same size as those in the Hutton seam. No pillars are yet worked away. Powder is used in getting this coal, which is hard in structure.

The air in circulation through the whole of the mines is about 20,000 cubic feet per minute. The underground conveyance of coal is effected by horses; engine-power is not adopted, owing, probably, to the limited distance of the boundaries from the pits. On the main roads 21 horses are employed, and for the workings 40 small ponies.

Near the Lamp Pit 76 coke-ovens are erected, in two double rows, dome-shaped, varying from 10, 10½, 11, to 12 ft. in diameter. These communicate to 19 chimneys, 10 feet in height and 2 feet square, or four ovens to each chimney, which is placed centrally between them; a side-flue, 3 ft. in length, 12 in. diameter, connects each oven to the chimney. These ovens originally burnt out at the crown-hole; the chimneys have since been added, affording a great advantage in regulating the burning and coking of the coal. The Low Main and Hutton coals are used mixed together in the ovens; they are charged at the doors, and the coke is drawn by rake. A portion of these ovens have been in use 26 years, with but slight repairs; the original bricks still remain in them.

At each establishment there are smiths' and joiners' shops. At the Lamp pit a portable engine, by Clayton and Shuttleworth, with an 8½-in. cylinder, horizontal, 12-in. stoke, and 31-tubed boiler, drives circular saw by one belt for colliery purposes.

There are gas works erected near the Lamp and Kettledrum pits, by which the top of the pits and screens, &c., are lighted.

The Farm engine, by Coulthard, has one 10-in. horizontal cylinder, 18-in. stoke, Cornish boiler, 10 by 4 ft., 30-lbs. steam pressure. This engine drives, by shafting and two belts, one hay and straw cutter; also one crusher, where all the oats, beans, and peas consumed on the concern are first crushed. The same engine—by shafting, one belt, and wheel-work—drives a thrashing and winnowing machine for the use of the farm attached to the colliery.

[Note.—In the account of Walbottle and neighbouring collieries given in last week's Journal please to correct an error. The coal vended in the year 1602 by 28 fitters or hostmen should have been 190,600 tons.]

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Furnaces for Separating Ores.—By the invention of Mr. J. Y. Smith, Pittsburg, U.S., there is a cylinder or pulley, around which the endless apron is carried, and a magnet cylinder, around which the apron also passes. This cylinder may be constructed in three parts—the two pulleys, which with the shaft carry the apron, and an intermediate part, the surface of which is formed by a series of magnets, which may be either permanent or electro magnets. These magnets are attached to a central core of wood, and as it is sometimes desirable to make the magnets revolve at a speed different from that at which the belt travels the shaft of the central core should pass through tubular shafts which carry the pulleys. The magnets may be arranged to present their points at the periphery of the magnet cylinder, or they may be bent so as to present the sides of the magnets towards the apron, thereby increasing the extent of the magnetised surface. The ore is poured from the hopper upon the surface of the apron, and in the form indicated; the non-magnetic particles will fall by their own gravity from the apron as soon as they have been carried beyond the horizontal diameter of the magnet cylinder, whereas particles of iron or magnetic ore will be held by the attractive action of the magnets against the apron until (when the apron carried away from the magnet cylinder passes beyond the range of influence of the magnets) the particles of iron or magnetic iron ore will fall by the action of gravity from the apron. To facilitate the separation of the non-magnetic from the magnetic particles a blast of air from a fan, carried through pipes, may be directed against the breast of the magnet cylinder.

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### THE MANUFACTURING INDUSTRY OF SCOTLAND.

#### THE COATBRIDGE TIN-PLATE WORKS.

The industrial resources of the West of Scotland have within recent years been developed to a most extraordinary extent. The manufacture of iron, in its various forms and qualities, has long been a distinguishing feature of the district round about Glasgow, and more recently the Clyde has won a reputation for marine architecture second to that of no other river in the kingdom. Indeed, it may be safely affirmed that no branch of the iron trade has been more indigenous, so to speak, to Scotland than that which deals with the manufacture of ship-plates, and since its first introduction this department of industry has been carried on with unremitting success. A similar remark cannot apply to the manufacture of tin-plates, a cognate branch of trade, which was commenced some 20 years or more ago; but had after a short trial to be abandoned, in favour of Staffordshire and Wales, where this description of product could, to all appearances, be turned out under much more favourable conditions. Nothing daunted by the reverses which had attended the first venture of the kind made in Scotland, Mr. Edwd. Bell, the managing partner of the Coatbridge Tin-Plate Company (Limited), started the works about seven years ago, over the destinies of which he presides with much tact and energy. The tin-plate works, which are situated in the great iron manufacturing district of which Coatbridge is the centre, and near to the Gartsherrie Ironworks, were originally built on a much smaller scale than at present, but they have from time to time been extended to meet the exigencies of a prosperous and constantly increasing business. From the fact that they are the only works of the kind in Scotland, and that in some important respects they differ from any other establishment of the kind in the Empire, a description of the operations carried on, and of the works as they now stand, may prove interesting to many of our readers.

Bounded on the one side by the Caledonian Railway direct line between Glasgow and the South, and on the other by the Monkland Canal, the Coatbridge Works occupy a very suitable and advantageous situation. The roof covering that part of the establishment in which puddling and other preliminary operations are carried on consists of 10 spans. Four of the spans are of wrought-iron, and 429 feet in length by 30 feet wide respectively. The others are constructed of wood, covered with slates, and the roof throughout is supported on iron columns, and open at every side, like ordinary malleable ironworks. There are thirteen reverberatory puddling furnaces, of the usual size and construction; three ball furnaces, one of them being built on Gorman's patent principle; two furnaces for the strip mill, two furnaces for the sheet mill, two furnaces for the tin mill, and one annealing furnace. With reference to Gorman's patent heat restoring gas furnace, which has now been before the public for some time, it may be explained that it is similar in arrangement to the ordinary balling or re-heating furnace, and occupies about the same space. It differs only in the mode of generating the heat, and in having an apparatus, called a restorer, added for returning of the waste heat. By this furnace the solid part of the coal is converted into carbonic oxide gas, which is combustible, and along with the coal gas is burned with a further supply of air in the part of the furnace where the heat is wanted. By this process the heat from the gas, as well as from the solid part of the coal, is obtained. So far the furnace has been found to work very well.

In the manufacture of tin-plates puddling operations are carried on in the usual manner, but on this part of our subject we shall have more to say hereafter. As a rule Scotch pig is used, with an admixture of English iron, for tin-plates and sheets. In addition, however, to tin-plates, light boiler-plates, strip iron for making locomotive and gas tubes, sheets of all kinds, up the very finest quality of charcoal sheets, are made at these works; but it may be worth while to note that this is the only place in Scotland where charcoal strips are regularly made. Throughout the works there are eight Cornish two-flued boilers, each of them 26 feet long by 6 feet diameter. Five of these are furnace boilers. The company are now in course of adding to their steam power by the erection of two sets of Miller's patent cast-iron multitubular boilers, made by the Isca Foundry Company, Newport, Monmouthshire, which are placed so as to work in connection with either heating or puddling furnaces. Previous to their erection these boilers were tested to a pressure of 500 lbs. per square inch. Few if any of these boilers have as yet been introduced into Scotland, but as they are guaranteed to be free from explosion, and will yield as economical results as any other boiler in the market, their more general adoption can only be a matter of time. Many of our readers will be aware that Miller's boiler is made of cast-iron, in contradistinction to wrought or malleable iron, of which the ordinary Cornish boilers are constructed, and being multitubular it possesses the inestimable quality of generating steam very rapidly, while it also superheats the steam, and delivers it very dry to the engine. When these new boilers shall have been completed the steam power, which has hitherto been rather deficient, will be adequate for all purposes. The furnaces are so arranged that one works into each boiler. The machinery is driven by two pairs of large coupled engines, one pair of which, attached to the strip mill and forge, are of 150-horse power, 24-in. cylinder, and 4-ft. stroke. The other pair of engines, driving the tin and sheet mills, are of 160-horse power, 26-in. cylinders, and 4 ft. 6 in. stroke. Both of these engines work at a pressure of 45 lbs. There is another small engine, 30-horse power, 18-in. cylinder, and 3 ft. 6 in. stroke, for working the cold rolls. The ponderous fly-wheels of the larger engines will weigh respectively from 18 to 20 tons, and are about 18 ft. diameter. The one pair of coupled engines have been at work since the premises were built, seven years ago; the other pair were added about four years later, when a considerable extension of the works took place. Strathearn, Murray, and Co., of the Coatbank Engine Works, at Whifflet, supplied the second pair, and M'Gilchrist and Co., of the Atlas Works, Coatbridge, built the first. In addition to the furnaces already indicated, there are two hollow fires, one of them a patent by Mr. William Gorman, of Glasgow, in which sheets and tin-plates of the best quality are manipulated. We understand that this fire is an adaptation of Mr. Gorman's patent, intended for tin-plates, and that there is no other fire of similar construction in the country. The main difference between the Gorman

fire and the ordinary furnace is that the former has six doors instead of one, and the materials under manipulation are heated by an intense white gas-flame. The common hollow fire is in general use throughout both England and Wales, and has only two doors. While these only produce 25 cwts. a shift or turn, this new hollow fire will produce 50 cwts. of tin bars, with 30 cwts. of Scotch coal.

The process of making tin-plates is of a very complicated, laborious, and expensive character. The *modus operandi* adopted in the Coatbridge Works is as follows:—The charcoal iron for tin-plates or sheets is produced from refined metal and scrap iron, charcoal being the fuel employed. After several heatings and hammerings it becomes finished bar, and is as clear as silver. The pig-iron, intended for use, is first puddled in an ordinary puddling furnace in the usual manner, although more pains is taken to have the iron brought to a due consistency than in the manipulation of pig for common malleable purposes. After the metal takes the shape of finished bars it is cut up into pieces, varying in length according to the standard required. It is afterwards placed in a heating furnace, where it is heated at a very low temperature, and taken out at a cherry-red heat. The next stage of its progress is a passage through the rolls, through which it is passed five or six times, in order to obtain the exact gauge required. The gauge varies from 20 to 40. The plates are next sheared to various sizes, including all odd sizes, and after passing through a chemical process, known as pickling, or clearing (which is carried on by the use of sulphuric acid, diluted with water), in order to remove the oxide previous to annealing, they are placed in water, where the acid is thoroughly washed off. Subsequently the plates are packed in square iron cases, placed in a large annealing furnace, where they are permitted to lie for several hours, passed five, six, or more times through cold rolls, and after the operation is completed they are re-packed in the same iron cases, and re-annealed in the furnace for some hours longer. When they are removed from the annealing furnace for the second time the plates have assumed a nice bright lead colour, but they are yet a long way from the proper consistency of tin. They have again to be taken from the boxes into which they were packed for annealing purposes, and they are next subjected to a process which is described as white pickling, in which sulphuric acid, abundantly diluted with water, is used to remove any oxide that may still adhere to the plate. The work of pickling the plates is performed by women, who afterwards scour and wash them in a thorough manner. In preparing the plates for coating, they are placed in a vat full of palm oil, from which, after the oil has had time to operate upon them, they are removed to a second vat close beside, and full of block tin in a molten condition. When they are next exposed to the light of day they present a beautifully clear and white surface, and the operations remaining to be performed are almost similar to those already described. Being extracted from the first pot of block tin, the plates are dipped into another pot of metal, from which they are taken, and well brushed on both sides, re-dipped in another pot of still purer metal, drawn through another vat of palm oil, from which they are taken in an almost finished state. The bead which attaches to the head of the plate in the final process is removed by dipping it into a smaller pot of the block tin, and after they have been well rubbed with the sharps, or what in Scotland is called the thirds, of flour, they are polished with sheepskin, and packed in boxes for exportation. Immediately before being packed the plates are individually examined on both sides by a workman, who separates the perfect from the waste, and counts them at the same time. If a plate is found to be in any way imperfect it is sent back to be repaired, or sold as "waster." The bad plates are, however, readily bought up by travelling tinkers, who delight to haunt the locality of the tin mills, because they can purchase the material for the manufacture of their wares at a more economical figure than they could elsewhere.

We may mention that the works contain, in addition to the machinery already indicated, two pairs of shears for shearing strips and plates. One of these has only just been erected, and was used last week for the first time. The one shears is capable of cutting a ¾-in. plate, and the other can manipulate on a ⅝-in. plate. Another shears, made by Craig and Donald, of Johnstone, is used for cutting bar-iron. It will cut an ordinary permanent rail, or a 7-in. by 1½-in. bar. Another pair of shears is for sheet-iron, and two pairs are adapted for tin-plates. An engine of 30-horse power and 18-inch cylinder is placed outside the works, for supplying the blast to the refinery and two charcoal fires, while it is also used to pump water from a small stream that runs near at hand.

From what we have already indicated it will be apparent that the Coatbridge Tin-Plate Company are not slow to give a fair trial to any new invention which claims superiority in any respect over others already in the market. Acting on this principle, they are now introducing a series of Moorwood's patent pots, which are found to coat tin-plates much more readily and economically than the old system of hand-drawing by passing them through iron rolls, which are fitted up in the vat containing the palm oil. These rolls are worked by a small engine. Attached to the works there is a small foundry, and an engineering shop and a saw-mill are now in course of construction, so that the company will be enabled to execute all repairs on the premises. The blast for the smiths' and the hollow fires is supplied by a large receiver, about 36 feet in length, from which a pressure of 3 lbs. to the square inch can always be reckoned on. A number of steam-hammers and cranes are placed conveniently throughout the works. Efforts are made in every way to carry on the works as economically as possible. In the first pickling process the waste vitriol is economised, and converted into copperas. The waste heat from the furnaces is economised in the boilers, and the products of the charcoal, of which a large quantity is made on the premises, are used in making acetic acid and iron liquor. Lines run through the works from the Calidonian main line of railway, and at the present time a line of rails is being laid that will go completely round the works, and afford the most complete and ready facilities of carriage. The works are well employed at the present time, although operations have recently been interfered with by the strike among the puddlers in the West of Scotland.

## MINE CAPTAINS, AND THEIR EDUCATION.

SIR,—Your correspondent, Mr. J. Roberts, seems to be desirous that the continental system of placing the management of mines in the hands of certificated mine agents should be introduced into this country, but if this is really his opinion I believe his views are opposed to those of most practical mine agents, and that it would be the ruin of our mineral interests, and most of all detrimental to working miners. No one disputes, and no one ever has disputed, that sound elementary education is essential to the young of all classes, whether their after life is to be occupied in the mine, in the workshop, or in the House of Commons, but experience, which after all is the best teacher, tells us that the best men in any trade or profession are always those with the least theoretical training. Had Trevithick been taught mathematics and classics we should most likely never have had the steam-engine applied to the purposes of locomotion, and had James Watt been born rich, and been educated into a great scholar, we should most likely still have been drawing our water with barrels and whims, or using engines scarcely more economic. It is the natural genuises that become great inventors, and do real good to their fellow-men; and instructed gentlemen who destroy the interests of inventors, by giving to the world machines which they call new inventions, but which are only bad copies of the real inventions, just altered enough to prevent the inventor catching hold of them, and demanding that royalty to which he is justly entitled.

If a boy can read and write well when he first gets employment he will soon find out what sort of knowledge will help him forward the most, and he will find it easy enough to get that knowledge in ninety-nine cases out of a hundred, and the very trouble he has in getting it makes him all the sharper, until at last he can grasp anything connected with his favourite subject very quickly, and decide what is right or wrong concerning it almost by instinct. Men who have got their knowledge in this way are always quicker in comprehending the effect, or the probable effect, of different circumstances than they who are hampered by theoretical notions, which they have got from learned professors. While the professor's man is labouring to prove that a thing cannot be done, that it is impossible, and that if it could be done it would be no use, the man who has laboured to get his knowledge, just as he has laboured to get his bread, goes and does it, does it cheapily, and makes it an unheard-of success. This comes about because one man considers what particular rule of mathematics, or natural history, or some other science that has nothing to do with it, ought to be used, while the other only thinks how it can be done, and does it.

And let me ask what would be the result of all foremen and managers of works (for, of course, there should be no special arrangements for one particular class) had to get certificates before they could be employed in those positions? Why, no common workman would ever be more than a common workman, and he would have to work under foremen and managers who might know little of the practical part of the trade, though they might have more book knowledge. It is all very well to say that if the working man did get the book knowledge he would have the best chance, because he would have the practical knowledge also, but I say that if the examination were of a proper quality it would be impossible for the working man, with only the time between his hours of labour to call his own, to compete successfully with the sons of foremen and managers who could give their whole time to learning. In this way we should get in our workshops, in our mines, and in every other place where there are workmen as much caste as we read about in India. This is already the case in Germany, where entire families are foremen, and other entire families can never get beyond working men, no matter how they strive, and among these last I have met some excellent and intelligent fellows who deserve a better fate, and who in England, I am sure, would get it.

It does not matter whether it is in mines or workshops, the employers must have the power to put the best men in the best places, no matter whether they are educated or not so long as they understand their business, and are sober and honest. As a rule, employers prefer men who are not highly educated, not because they do not like them to have knowledge, but because that sort of man is always a better workman, and gives more thought to his business. It is this sort of men that we want to enable us to compete with foreigners. The value of money is so different in England and on the Continent that a German or a Frenchman getting 9s. or 10s. per week wages lives better than an Englishman who has 30s. or 35s.; and to equalise the value of money is not possible, but the practical English workman is so much superior to the theoretical foreign workman that we are still able to compete with him, though we have sold the foreign employer our best machines, and let him have our practical foremen to teach his highly-educated (?) workmen until the foreign employer can trust those workmen to carry on the works "precisely as the (uneducated) Englishman has done it." The English foreman is then sent about his business, and manufactures in every way similar to the English are sent into the market at one-third the price at which Englishmen can supply them. It is not, then, the superior technical knowledge of the foreigner that enables him to beat us in markets we formerly had exclusive control of, but the habit he has contracted of copying us in every detail, and throwing to the winds all that technical knowledge we hear and read so much about.

*Manchester, March* 15. TRAVELLER.

## INDUSTRIAL AND TECHNICAL EDUCATION.

SIR,—Your correspondent, "Mine Agent," writing from St. Teath, says—"At the Royal School of Mines and at the local mining schools in Cornwall it has been difficult to get a half dozen students at each class." It is much to be regretted that "Mine Agent" had not made himself better acquainted with the true position of things before he volunteered this statement. The attendance of students in the classes of the Royal School of Mines will be above one hundred. Of "local mining schools in Cornwall" there are now eight in active operation, several of these classes having twenty students on their lists, the average attendance of each being twelve students at every meeting. Kindly allow me to make this correction, since a loose statement of this kind is calculated to do much mischief.

ROBERT HUNT, F.R.S.,
Hon. Gen. Sec. Miners' Association of Cornwall.

## THE INSPECTION OF MINES IN SOUTH STAFFORDSHIRE.

SIR,—You will, I am sure, allow me space to say a few words upon the very unfair attack which "Viewer" last week made upon her Majesty's Inspector of Mines for South Staffordshire and East Worcestershire. I am not at all surprised that when an Inspector does his duty, and that duty involves the punishing of persons who commit offences against the Mines Inspection Act, the result should be to make the Inspector unpopular with those who suffer from their own negligence or want of duty. That, however, does not justify such persons in making an attack upon an Inspector in the terms used by the correspondent I have named. He says that in South Staffordshire a friendly feeling does not exist between Mr. Baker and a large portion of those with whom he is brought into contact. Well, if the writer here means by "a large portion" the scores of persons who during the last ten years have been convicted in South Staffordshire and fined in various amounts ranging from 1*s.* to 20*l.* for infringements of the Mines Inspection Act, then I can understand his allusion; for amongst such it is impossible that there should be a very hearty feeling of sympathy with a man who has done his duty with so much disregard of persons or social stations—being influenced by one desire only, and that to carry out to the best of his ability the provisions of the statutes which the Legislature in its wisdom has deemed essential to the safety of those of our countrymen who at so much peril, and for so little remuneration, take daily their lives in their hands to procure for us that which is now a necessary, not only of our domestic but also of our commercial existence.

South Staffordshire, I fear, has obtained unenviable notoriety in this matter of infringements of the Mines Inspection Act. That may be inferred from the figures I have just quoted. But if the doing of his duty in these matters has lost the Inspector for South Staffordshire some good wishes that perhaps he would have received if he had been less active and less impartial, it must have given him cause for satisfaction of a character to which the good opinions he may have lost are not worthy for a moment to compare. His stern determination to protect the lives of the poor men who work underground has not been without the most happy results—results at which you, Sir, I am sure will rejoice, even if they should be thought of only little consequence by some men who in our colliery districts hold life so cheap.

Let me, then, by an examination of the annual reports of the Inspectors, which are now before me, try to learn what has been the result of inspection in South Staffordshire during the last nine years—the period, may I add, during which this alleged unpopular Inspector has had the charge of that district. I find that the Inspection Act came into operation about the year 1850. From that date to the year 1860, inclusive, the annual average death rate for the ten years was 162·5. During the last nine years—*i.e.*, to 1869 inclusive—the annual average death rate has been 110·8, thus showing a diminution of about 52 lives annually, or one home a-week saved from the misery resulting from the violent death of a bread-winner throughout nine consecutive years. And I have reason to know that the result of inspection in this district in the year the returns for which have yet to be published will show a still further diminution. But these figures, satisfactory as they undoubtedly are, do not represent all that has been done; for I perceive that the get of coal and the number of persons employed have greatly increased during the last of the two decades of which I am writing. So much, then, for the inspection of mines in South Staffordhire. Need I say any more in defence of a Government officer whose works plead with so much force and eloquence without any eulogium of mine—in defence, moreover, of a man who by his official position is debarred from answering such attacks, even if he should think them worthy of his notice?

Now, as to the particular cases which seem to have called forth "Viewer's" letter. Relative to the lapse of time between the laying of the information and the magisterial proceedings, that was sufficiently explained on both occasions by the solicitor for the prosecution. "Viewer" also says that the road in which the boy was found was a disused portion of the pit. Here again "Viewer" has not made himself acquainted with the correct circumstances. It is well known that the headway in Turner's case—and this the plan produced in the proceedings clearly showed—was driven into a pillar of solid coal that was afterwards worked out. This, therefore, could not be a "disused portion of the pit." Indeed, the workings in the vicinity of the very place at which the boy lost his life were carried on for weeks, if not months, after the accident.

Respecting Fletcher's case, in which the magistrates imposed a fine of 5*l.*, but in relation to which "Viewer" says he cannot understand why they should have done so, need I do more than call attention to the fact that the case was decided by a bench of no fewer than four magistrates? With regard to the case that was withdrawn against Fletcher, "Viewer" says that he was charged in that instance with neglecting to fence an unused portion of the pit. The Inspector had, no doubt, good reason for taking the course he did; and to show that he was right it is only fair to state that I know, on the most reliable authority, that the place in question has been abandoned, and not interfered with, since the accident.

How "Viewer" can come to the conclusion that there is no proof of neglect on the part of the persons liable under the Act of Parliament I am at a loss to understand, inasmuch as it was distinctly proved by all the witnesses examined, and the plans showed, that no provision of any kind whatever, except the elbow-pipe in Fletcher's case, had been made for the ventilation of the place where the unfortunate people lost their lives. As to "Viewer's" statement that the Inspector seldom visits them unless there has been an accident, "Viewer" must surely be very ignorant of the habits of the Inspector, who, when he is not incapacitated by occasional illness, is every working day the year round in some one or another of the collieries of his district, whether there has been a fatal accident or not.

I have trespassed, I fear, upon your valuable space, but as this is all that I shall trouble you with upon the subject I trust that its importance in respect of the professional conduct of a painstaking and successful Government officer will be a sufficient apology, and that you will deem it only fair that it should have as conspicuous a place in the Journal as that given to the attack which has called it forth.

ONE FAMILIAR WITH THE WHOLE CASE.

## MINES REGULATION BILL.

SIR,—In the case of an explosion of fire-damp a writer took occasion to draw attention to the necessity of passing a law, without restriction, that all mines should be worked with lamps, and the use of gunpowder put under proper regulations. The Mines Regulation Bill does not in the least touch upon this important point, although almost every week we have reports of explosions more or less destructive. It is strange that so little notice should be taken of them by the press. When a railway accident, or bursting of a boiler, takes place all sorts of opinions are expressed and remedies suggested, eventually leading to laws being passed to prevent them. It is quite certain that coal-getting cannot be carried on without having to contend with that invisible foe—fire-damp—more or less, some pits having large quantities, and others almost without. It is also quite certain that the deeper they are carried, and greater the distance over which they extend, will only increase the number of explosions in future years, if the present system is continued. A mine may be worked for years and no accident occur, when in a day something unforeseen takes place, and then loss of life and destruction of property are the result. Gas will not ignite unless it comes in contact with a naked light. Now, whether it is ignited by the flame of a blown-out shot or by a candle, it could and ought to be prevented.

First of all, what are the causes of blown-out shots? In most cases from inexperience, or overcharging the shot with powder, or some other cause that would not be if men were appointed to see every shot charged, or do it themselves, that thoroughly understood their business. Then, could not the shots be fired when the men were all out of the pit? This would prevent loss of life to the men from that cause. Again, the Davy lamp has been the means of saving thousands of lives, and if it is not a complete safety against explosion, it is so in 19 cases out of 20, and the reason it is not in the twentieth is owing to the construction of the lamp, together with the facility with which a man can tamper with his light. But a really safe lamp can be found, and it only remains for a few of the most eminent engineers to get all kinds together and decide which is the best, then let it be adopted universally. Make no difference, but let a clause be inserted that nothing but lamps shall be used in the workings of coal mines. At the same time they should not be depended upon entirely as an excuse for carelessness and neglect in giving the right quantity of ventilation, but keeping the mine in the most perfect state of safety, that they might be worked with candles, simply using them as a means of safety in the event of an unforseen accident taking place.

The lamps should be kept in perfect order, and never allowed in the men's hands for any purpose except to work with, and only then when locked in such a way that a man cannot possibly tamper with them. Even where lamps are used in some cases the men take the top home to clean, and the easiest way to do so is putting it in the fire, and the least thing will cause the gauze to snap. The lock is a perfect farce: any boy with a nail, or a bit of wood and a penknife, can open them with the greatest ease. In some cases the men buy their own lamps and oil, and have full control of them, taking both top and bottom home, and using them till the thread is so worn that the bottom has been known to drop from the top, or gauze part. The lampman ought to examine them daily, and at stated intervals some one in authority should do so also, and put aside for repairs or condemn as unfit for use all those that are not up to the work.

I shall be glad to hear the opinion of others, and if this letter should induce others to enquire into the question I have little doubt that it is not too late to do something before the new Bill is passed through both Houses to remedy this state of things.

*Manchester, March* 14. PREVENTION.

## SOUTH WALES COLLIERY COMPANY.

SIR,—The somewhat unsatisfactory progress that has been made by this company for some time past may, I think, be attributed entirely to the want of unity that has hitherto existed among the shareholders and directors—so that by the proceedings at the last meeting we may anticipate the inauguration of a period of great prosperity. The withdrawal of Mr. Heyworth from the office of managing director may be regarded as a matter for congratulation, without at all questioning the ability with which he has managed the concern. With regard to the leasing of the farm it appears that the managing director was not solely responsible for refusing the offer of 10*s.* per acre. But it is admitted that the man who made the offer had the money to pay the rent, and it seems that the company made a loss of nearly 400*l.* on the farm, so that had they leased it the company would at least have been 600*l.* in pocket. If the company could not make a profit out of the farm it does not follow that a farmer would be equally unsuccessful, and what the company should have done was this. They should have accepted the tenant and arranged with him to take the stock at a valuation, repaying the company by instalments extending over five or seven years. Perhaps this could be done even now, and the result might be that the company would avoid further loss, while an industrious man would be given an opportunity of establishing himself. A man of this class would, of course, make every attempt to succeed, because his all would be at stake, while to the officers of a large company a heavy loss becomes merely a matter of regret, but they individually lose nothing.

But, I think, the most important feature in connection with the future prospects of the company is the appointment of such men as Mr. Thomas Brown to a seat at the board—gentlemen who have devoted their lives to the business, and who will not have to tell a public meeting that they "know nothing themselves of mineral properties, or of working collieries." In saying this I do not mean that any member of the board has failed in his duty, but only that we want men better understanding the business of colliery owners to conduct our affairs. I quite agree with the observation that fell from one gentleman at the late meeting, that a great deal of the result of the current six months' working will be due to Mr. Heyworth's management, and what this result will be we may pretty well judge from the fact that in January there was a clear profit of 600*l.*, and that February and March were equally good months. It can no longer

be said that the shareholders are divided into about two equal camps, and that there is no doubt whether the directors' party form the larger or smaller of these. Henceforward we shall have influential local men at Newport to assist the men of business in London, so that we may fairly hope that all may go on as smoothly as the most anxious of us could desire.—*March* 15. SHAREHOLDER.

## THE PATENT LAWS—PARLIAMENTARY PROCEEDINGS.

SIR,—After the allusion to myself as a person likely to afford sound practical advice to the Legislature in regard to the Patent Laws, contained in your recent article on that matter, I cannot refrain from offering to place before the readers of the *Mining Journal* a summary of my views on the subject, which I can now do with some degree of completeness, Mr. Hinde Palmer's Bill having just been printed, and issued to the public.

Before stating my own views as to how this branch of law should be amended, I will make a few remarks on the policy of the patent system in opposition to the opinions recently enunciated in the House of Commons by Mr. Macfie and Mr. Samuda when the appointment of the committee on the Patent Laws was agreed to. These gentlemen and their sympathisers object to patents—First, on the ground that they interfere, as they allege, with freedom of trade. Now, the interference with trade, resulting from the action of the Patent Laws, *per se*, cannot in the present day be allowed as a sufficient ground for abolishing these laws *in toto*, for if so, our Mines Regulation Acts, Factory Acts, Smoke Consuming Acts, Alkali Acts, and other legislative measures for ensuring great social benefits to the people, which cannot be carried out without considerable interference with the freedom of manufacturing and trade operations, must be at once blotted out of our Statute Book. This, the anti-patent law party seem to have some dim perception of, for they take up a second point of objection, which they couple with the first, this latter point being a charge against the Patent Laws as failing to benefit inventors in the way they profess to do in securing to them the fruits of their labours. I am well aware that too often does the unfortunate inventor fail to reap the due reward of his ingenuity and labour, but deplorable as this may be, and strongly as it calls upon us to do our best to remedy such a grevious sore in the body politic, it is worth nothing as a statesman-like reason for abolishing these laws unless it can be shown that they do not form inducements to inventors to invent, and they, and those who aid them with capital, to publicly develope their inventions, so that the community at large thereby becomes possessed of practical improvements in the arts, and not, be it noted, mere suggestions upon paper. It is quite possible the latter might be furnished to the public if the Patent Laws were abolished, but would they ever get the improved articles and manufacturing processes, of which these suggestions are only the foundations? The mere speculative talk about capitalists aiding inventors with money (often thousands of pounds) to test and develope their inventions (so as to bring them before the public) from motives of philanthropy, public spirit, or prestige, is unworthy of men of commen sense. If these motives will suffice for inventors and the capitalists who aid their labours, why will they not suffice for the capitalists who provision, and clothe, and house our people? Let philanthropy, public spirit, and prestige do all those things for our millions, and then inventors and their friends cannot hope to uphold the Patent Laws; but until the time arrives when all this is effected the inventor and his capitalist cannot be expected to act upon motives totally different from those of the rest of mankind. The author demands copyright in his book, the artist and the engraver in their pictures and productions, the manufacturer in his new designs and trade marks, and the inventor expects to secure a patent right for his invention, whereby he may be enabled to offer a *quid pro quo* to the capitalist, and get remuneration from the public. But it is said that the Patent Laws foster the growth of pretended inventors, and the evil of "fishing patents" is much insisted upon. Now these, which are merely grants for speculative suggestions, and are put forward for the sake of the chance of their turning out to be practical ideas, although rife under the old Patent Law, are by no means considerable in number under the new Patent Act, 1852, as now administered. The provisional specification, and the stricter system adopted in its examination by the present Attorney-General, and other law officers, have rendered it a rare thing for a patent to pass which has not some reasonable amount of practicability about it; and it must never be forgotten in discussing this subject, that without novelty and practicability there can be no legal patent, so that on this head the objection, such as it is, is in truth an objection to the law being insufficiently guarded against abuse, and not to its policy.

So much for the old story of pro-patent law against anti-patent law. Now for the practical question of how it may be amended and rendered efficient for the security of the inventor and the protection of the public.

My propositions for the amendment of the Patent Laws are to some extent similar to those of Mr. Hinde Palmer, which, although not likely to effect all that could be wished, are, with some modifications, capable of accomplishing everything that the Legislature, in the present uncertain state of public opinion on the subject, is likely to accord to inventors.

1.—Mr. Hinde Palmer proposes to add three special commissioners (one legal and two scientific) to the present commission. I would, for purposes to be presently stated, add (say) four more scientific persons, as what might be termed extra commissioners. The special commissioners should receive regular stipends, and the extra commissioners be apportioned certain fixed allowances for any services from time to time rendered by them. The Commissioners should sit as a Court, for the purposes referred to in the Act. The President and Vice-President of the Board of Trade should be added to the list of Commissioners. Patent laws affect trade, and, therefore, the legal guardians of its interests ought to form part of the board.

2.—The Crown law officers should not be dispensed with altogether, but should have the position of Government Assessors to the board, and be charged with certain duties—they should have under their control the examination of provisional specifications (in which they ought to be assisted by competent persons), the hearing of, and deciding upon, all oppositions to patent grants, and upon all applications for disclaimers, memoranda of alteration and of addition (which should be allowed to be entered by the patentee or proprietor of the principal patent). In all these cases appeal should be allowed to the Commission sitting as a Court. No patent should be sealed and issued till the applicant for Letters Patent had made a declaration that he had made search and enquiry into the novelty and patentability of his invention, and filed his complete or final specification. Of course, if preliminary examination, as in America, is to be resorted to, this will be unnecessary. In that case I would make the law officers the judges (with ultimate appeal to the Patent Commission Court), in cases of objections by the examiners. To provide for the reasonable conduct of oppositions provisional specifications should be open to public inspection (not with power to take copies), seven days prior to the expiration of notice to proceed. The fee for entry of opposition should be 5s., the law officers' fees remaining as now.

3.—As proposed by Mr. Palmer, patentees should be allowed after three years, if the invention have been publicly used, and the patent right not disputed, or if a lawsuit has tested the validity of the patent, to call for opposers, and proceed to obtain an indefeasible patent. If it should be thought too much to the advantage of patentees to allow them to obtain an absolutely indefeasible right, then I would suggest that a qualified indefeasibility might be accorded—that is to say, that it should remain indisputable if no one successfully moved upon fresh evidence, or by showing fraud or collusion in the proceedings in re-opening the question. The proceedings should be before the Commissioners, sitting as a Court.

4.—Whenever in any case of infringement the defendant alleges that the patent is invalid, or that what he had done is no infringement of the patent, then those issues should be sent to be sifted, and tried by the Patent Commission Court, which should certify the result, and unless the referring Court should see reason to object to such result those issues should be deemed decided, and further if the validity of the patent should be disproved then the law officers should have the power to get the patent cancelled. In order to avoid unnecessary expense by agreement between the parties the real questions at issue might at once be taken to the Patent Commission Court, and tried, and their decision entered up as a judgment in one of the Superior Courts. The extra Commissioners should deal with re-references.

5.—In regard to the patent stamp duties, I agree to Mr. Palmer's proposition for making them one-half the present rates, with annual payments of 5*l.*; but I would separate the first payment of 2*l.* 10s. into two parts—namely, 10s. on the petition and 2*l.* on the certificate of allowance of provisional protection (which should be payable at the time of applying for it, until which time no examination should be commenced). This would give poor working-men inventors a chance of securing their rights on terms compatible with their means.

6.—Provisional protection should be unassailable by a patent which is granted upon a subsequent provisional specification, saving, of course, any case where it is shown to the Patent Commission Court that justice requires the substitution of the second provisional protection for the first.

7.—Compulsory licenses should not be granted unless the patent is locked up and not worked, or is not worked so as to keep pace with the demand.

The Patent Commission Court should, in subordination to the Privy Council, have jurisdiction in prolongations and confirmations of patents.—*Gray's Inn, March* 14. F. W. CAMPIN.

## THE PATENT LAW LEGISLATION.

SIR,—I have no doubt yourself and the readers of the Journal feel greatly interested and anxious respecting the Patent Laws, as lately discussed in the House of Commons. It appears to me that the present laws with a slight alteration may be made useful to all parties.

Mr. Samuelson, in the House, observed that, "Inventors were generally poor men, and were not in a position to carry out their inventions without the assistance of capitalists." And Mr. Mundella also stated in the House the same night that—"A great proportion of inventors were poor men; those men had, of necessity, to put themselves in the hands of capitalists, whose bargain with them was usually not founded on principles of equity or mutuality;" and he likewise added—"Numbers of men in the humbler ranks of life," &c.

Now, it is not the humble men Mr. Mundella mentions who have the greatest difficulty to bring out their inventions; they sometimes have masters or landlords to take them in hand. The greatest sufferer by the present laws is the poor gentleman, with his unfortunate fine feeling. He may formerly have been in a high position, with the command of money, but he must now combat with his pride, and degrade himself by borrowing a loan to bring out his invention. Such unhappy feelings an artizan would never understand. I have known one of these poor gentlemen, after having paid thousands for patents, to be compelled to live upon charity. In time these poor men may be fortunate enough to get introduced to an upstart capitalist, and have to submit to insults and coarse jokes respecting the invention, and insist on having the models made after his own taste, which may alter the whole arrangement. Such was the case with the gentleman above referred to.

I see no reason why our valuable inventors should be placed in such a sad situation; my plan would be to give the poor inventor sufficient money to enable him to make a rough model, which model to be examined by a competent and truthful few, bound to secrecy. Should it be passed, then to be entered and classified. Money enough should then be advanced to the inventor to take out his patent, &c., and any other expense—binding the inventor, should it prove a success, to pay fourfold, so that the successful should pay for the unsuccessful. We should then secure the best inventions to our country without any loss to the revenue.

We should make our institutions more self-supporting. I expect we shall soon be taxed again to recruit our army, which might be avoided, I should think, by instead of employing persons to collect the income tax papers or census papers, make everyone post them to London, under a penalty for non-compliance. See what an increase of revenue and how much more truth we should obtain without the annoyance of persons being inquisitive, and neighbours knowing all their private affairs, which causes them to object to the tax.
*March* 14. E. M. S. P.

## IMPROVED PUDDLING FURNACE.

SIR,—The distressing heat to which the puddler is exposed has been so frequently alluded to in the Journal that the importance of an invention for enabling a puddler to do his work with less fatigue will be readily understood. Not only will there be less inducement for the puddler to shirk his work, but the ironmaster himself will derive direct pecuniary advantage from having his iron better worked, and, therefore, of superior quality. Whether the men will be willing to give some little additional labour to the iron as compensation for the increased comfort and much diminished fatigue I do not know, but cannot think that they will be so unjust as to object to do so, for otherwise there would be no inducement for inventors to endeavour to improve the puddlers' condition by enabling them to get through more work with the same amount of labour. There is another thing, too, that the men should remember about inventions of this sort—they are well calculated to enable the puddler to keep the puddling in his own hands, by keeping hand puddling so far superior to machine puddling as to make the adoption of machine puddling more difficult than ever.

The invention that has caused me to write is one by Mr. James Russell, of the Forest Vale Works, Cinderford, the object of which is to protect the puddler from the heat of the furnace. Mr. Russell proposes to support parallel to, and at a short distance from, the front of the furnace three vertical screens, two of the said screens covering the front of the furnace on each side the puddling door, and the third screen nearly covering the said door, the hole in the door through which the puddler's rabble passes being left exposed. Each screen is made by preference of a plate or slab of cast or wrought iron. The edges of the middle screen or plate project over the inner edges of the side screens or plates, and the said middle screen is supported by a chain passing over pulleys, and provided with a counterbalance weight. The side plates or screens are supported by being hooked, or otherwise fastened, thereto. For the purpose of keeping the screens cool a trough is fixed at the bottom edges of each plate and at the outer side thereof, the trough of the middle plate or screen being situated above, and its ends project over the troughs of the side plates or screens. The troughs of the side plates are connected together by a pipe. Near the top and outside the plates or screens is a horizontal water-pipe pierced with a number of small holes a short distance apart. This water-pipe is supplied with water under pressure, a stop-cock regulating the passage of water. The water from the said pipe is projected in the form of a series of small jets on to the outer side of the projecting plates of the furnace, and runs down them in a continuous stream. The water having done its work it escapes into the bosh or water-box for cooling the puddlers' tools.

I have followed the description given in the patent pretty closely, because I thought it would best avoid misunderstanding, and I should like to say that I think it will prove a great boon to the puddler. As Mr. Russell is an ironmaster I suppose he has had the invention tried at his own works. If so, I think it would be a great kindness to all puddlers if he would state in the Journal how the arrangement answers, as he might thus be the means of getting the invention used in other districts, and so securing to other puddlers the comfort he offers to his own. UNDERHAND.
*Wolverhampton, March* 13.

## ROOFING SLATE AND KILLAS.

SIR,—Until I read Mr. J. Arthur Phillips's very valuable paper "On the Chemical Composition and Microscopic Constitution of Certain Cornish Rocks" (referred to in the *Mining Journal* of Feb. 25) I had no idea that the comparison of rocks offered so interesting a subject for study. Not being myself a miner, I am unable to judge whether the information given by Mr. Phillips can be made use of by practical miners in enabling them to determine where to find rich ore, but if it can, I should think a long series of such records would be invaluable, and would conduce to attract capital to the mines of Cornwall by facilitating the return of a larger percentage of profit upon the capital embarked. The interest usually taken by adventurers in mines is almost exclusively regulated by the amount of profit returned, and geological peculiarities have but little influence with them. From Mr. Phillips's analyses it appears that none of the killas contains any saleable metal, although I have observed in mine reports that killas is frequently referred to as being a very favourable indication. Indeed, this killas seems to me to be a peculiar kind of mineral altogether, but it seems that the most plentiful is a clay-slate of a grey, bluish-grey, or greenish-grey colour, and frequently acquires a buff tint from weathering.

Now, it has occurred to me that if this killas is so plentiful as it appears to me, and of the nature which Mr. Phillips's analyses would seem to indicate, the killas ought to be made marketable as well as the other ores. Comparing the Delabole Roofing Slate with the Botallack killas, the similarity of chemical composition is very great, or at least appears to me to be so. Nearly all the same ingredients seem to occur in each and in both lists, the silica and alumina appear to be the chief constituents. Now, could not the killas be, by some cheap process, cut into slabs and employed for the same purposes as slate? Of course, I can understand that it would be inapplicable as roofing slates, owing to the absence of the property of splitting into thin sheets, but I suppose it could be used for flagging and such like purposes. But above all, I think it would be invaluable in connection with the asphalte paying now being laid in London, which wants a cheap solid backing. If the killas could be brought to London and sold in cubes of a foot each at (say) 2d. a cube there would be an almost unlimited demand for it, as it could be used beneath the asphalte in this way. The cubes would be laid regularly, but about an inch apart, so as just to catch the concrete to be run over it. This should be a good Portland cement or hydraulic lime concrete, and should be carefully levelled to receive the asphalte. In this way a very solid bedding for the asphalte would be obtained, and "dishing" would be entirely avoided. The great question is at what price per cubic yard can the killas in blocks be delivered in London?—*City, March* 14. C. G.

## TERRAS (TIN) AND ITS LOCALITY.

SIR,—This valley has been streamed over twice for tin, evidently washed down from the backs of the lodes, and pits have been sunk on the backs of the lode by the old tinners, who went as deep as they could go for water (after tin, of course), and this was done even in the bed of the river in summer, when the water was very low. They paid the lord his dues according to agreement; and as a proof they did well, some of the men did nothing else, but commenced work while young and left it when old at the stream. Tin not only abounds in the lodes, elvan courses, and strata, as described in my paper last week, but also in beds of clay-slate (killas), and in remunerative quantities. I might name Mulberry, which has, probably, been at work for the last 200 years, where the concern is worked as an open quarry, and the stuff taken to the stamps by a tramway, and although the average yield of tin is only 5 lbs. to a ton of stuff, they made a profit last year of more than 2000*l.* They stamp with both water and steam power. The mineralised mass carries the tin in the joints of the killas, and although it is of immense width—many fathoms wide—it is a defined body, carrying walls and runs consistantly, like a lode. There are other places of minor importance, where the yield is even less than 3 lbs. of tin to 1 ton of stuff (worked by water-wheels), and they make from 300*l.* to about 500*l.* annual profit. This may appear strange to some, but when it is considered that the tin is found at surface, water-power, dressing-floors, self-acting (almost) overhead knocks, and 30 cwts. a day, rough grate, &c., it may be a sufficient explanation. Let those who doubt it, however, go and see for themselves. Terras is gradually improving; the dressing-floors are being laid out in detail; this will not only increase the yield, but the sales of tin also. No wonder that the manager was so sanguine. A good mine is a prize, and the manager saw it first. There may be those who envy the mine, but cannot say a good word even to tell the truth. Criticism, however, will be put to silence by matter of fact. Time only is necessary to establish a good and lasting paying mine. To erect steam-engines and stamps, lay out spacious dressing-floors, sink shafts (even shallow ones), drive levels, and a variety of other work, never was done in a few months anywhere. Improvements are being made. The stone-breaker is at work, and it answers admirably in dispatching the work, as well as saving the cost. The stamps are doing more work, and the consumption of fuel is about 15 cwts. per day less than heretofore. Fresh light is being seen by opening up new places, and this applies to the locality at large. In taking fresh setts care should be taken to include elvan courses, as in this locality especially they feed the lodes, and can scarcely fail to open up good under such circumstances. I hear a fresh mine is going to work on the other side of the river, where they have already erected a new water-stamps, with 16 heads, and made satisfactory trials, and sold tin; in fact, it is only divided from Terras by the river, and embraces most of the elvan courses and lodes in that property. The sett is very large—I am told about 300 acres—and the lodes (which are many) run through the entire length of the sett; the backs of them have been laid open, and found to contain tin in many places in paying quantities. The geological features are identical with Terras, with the same veins, and contiguous to it. This will, I am told, make a great noise shortly, as it is said it will rival its best neighbour. I shall refer to it again.—*March* 15. AN OLD MINE AGENT.

## TERRAS TIN MINING DISTRICT.

### ST. STEPHEN'S-IN-BRAMWELL, CORNWALL.

SIR,—No district in Cornwall has been so neglected as this, considering its geological position, the cause of which can be owing only to a disregard of the natural book of geology, whose silent pages are here laying open to an observant eye that which clearly describes its metallic value.

I have several young mines of great promise in this district under my supervision, the most extensive of which is the Fortescue Consols, which has been worked by a private company for several years, and from which monthly returns of tin are being made. The deepest part of the mine is, however, only 18 fathoms below surface, which is the water level. The lodes at this point are very productive for tin. Hosken's lode is 6 ft. wide, and is worth 3¼ cwts. of black tin to the 100 sacks; James's north lode is very rich in places, being over 70 per cent. pure tin; James's south lode, Hardhead lode, Marshall lode, and the caunter lodes, are also very productive for tin. The tinstone is being stamped by water-power; and in order to further develope this valuable property steam pumping machinery must be erected, when, from the geological and mineralogical features of the lodes, and taking into consideration the shallowness of the workings, the tin already taken out of these shallow workings, the tin that is being sold monthly, and the improvement of the lodes in going down, that by the erection of steam-power a great and valuable mine will be opened up. The discoveries in the Terras Mine have of late drawn public attention to this district, which I am pleased to see is about to assume that shape which its merit demands. A map of the district, showing its geological position, &c., is in preparation by Mr. R. Symons, of Truro and London. It embraces a large extent of valuable mining property, and joins the St. Austell mining district, in close proximity to the once-celebrated Great Hewas, Great Polgooth, &c. Under the same geological features, but further to the east, are the well-known Bucklers, Boscundle, Wheal Eliza, Great Crinnis, East Crinnis, New Pembroke, Old Pembroke, &c., all of which are too well known to need comment.

I have surveyed many of the richest mining localities in this county, and not one do I know of that is more favourably situate, with regard to a geological point of view, than the Terras district. It would fill too much space of your valuable Journal to enter into detail to describe the various geological points attending this district; suffice it to say that it has within its limits the junction of clay-slate and granite, a feature of the highest importance, which is noticeable in many parts of the world for the production of stanniferous wealth; the stratification is of a buff-coloured clay-slate, analagous to that of the mines already referred to, traversed by groups of large and well-defined lodes and highly congenial elvan courses, both porphyritic and granatic, and cross-courses intersecting the lodes and elvans at nearly right angles. The geological position should always be well considered. Geology is the index to all metallic deposits, and is a natural science or knowledge of that department which embraces all that can be known of the formation of the strata or rock composing the crust of the earth in the investigation

of the processes concerned in the production of that structure, and the history of their action, by which we may understand the nature and position of the different masses of mineral matter of which the crust of the globe is composed ; it tells us that all metallic deposits derive their existence from their mother strata, hence we find a distinct relation between the contents of a vein or lode and the nature of the adjoining strata, both of which it is necessary to analyse, study, and define in order to arrive at conclusions. And since it is the property of the rock in which the veins are found to be congenial or otherwise to the ores, it is of the greatest importance that we turn our attention to that point.

*Cornwall, March* 14. JAMES HARRIS-JAMES, M.E.

## ORE DRESSING—No. I.

SIR,—I have lately noticed in the Journal several papers on Ore Dressing Machinery, and as the importance of this branch of the science of mining seems now to be forcing its way more and more before the notice of our practical miners, perhaps a few remarks on the subject may not come amiss. Most notices and pamphlets which have appeared from time to time upon this subject have been gotten up, not for the purpose of instruction in the rudiments and principles of this science, but simply for the purpose of advertising some one particular machine, and therefore everything which is said in them tends simply to the one point of bringing out the advantages of the machine in question. Now, the great mistakes made by nearly all inventors, and also by a great number of mining captains and superintendents, are, first, to imagine that an entire separation can always take place; and, secondly, that this separation is to be made with the aid of one machine. Nothing can be more fallacious as a general rule than these ideas. There are very few ores indeed which allow of a perfect separation from their gangues, except at a great expense, and therefore all efforts to pass a certain point in the operation are simply a waste of money. The aim of a practical miner ought not to be the getting out of one ton of perfectly pure ore from ten tons of mine stuff, but to produce, if possible, five tons of such a value as will pay a fair profit on the working. Then, again, a miner hears of or sees a machine working wonders at a neighbouring mine and at once comes to the conclusion that it is just what he wants, and so orders it, without for one moment considering whether the principle on which it works is adapted to his ores or not. Possibly he may, all the time, be using machines which are far better adapted to his wants, though the results he is obtaining may not nearly approach those of the new wonder. Were he to enquire into the case, it is more than likely he would find that these splendid results stand compared only to some very defective or inefficient apparatus, which had been previously in use, and that when compared to what he is doing they will dwindle down to a mere nothing. All this might be remedied were more attention paid at the different mining schools to the real science of ore dressing. At present, there is, I believe, one institution, the "Vienna School of Mines," where the art of the mechanical preparation of ores is thoroughly taught, and certainly a more able man to teach it could not be found than Prof. Rittinger.

The dressing or mechanical preparation of ores comprises two different and quite distinct systems ; the dry system, or air separation, and the water system. Each of these systems comprises four distinct operations—1. Hand sorting ; 2. Crushing ; 3. Sizing ; and 4. Concentration. All rational ore dressing *must* comprise these four heads. It is perfectly impossible to omit one of them would you work profitably with the other three. A great many inventors patent machines which are said to concentrate and size the ore in one operation. No idea could be more irrational. Why, the very basis of all ore dressing lies in the difference of the specific gravity of the different minerals and their gangues, and how then is it possible to use this fact when grains of a different size are used at one time? Between many of our ores the difference of specific gravity is very slight, and therefore a very small difference in the size of the grains of ore treated will entirely mar the effect of a delicate machine, and from being a good concentrator it will merely become a very indifferent sizing machine. I have no hesitation in saying, therefore, that after the ore is once crushed a good system of sizing is the key to all the other operations of concentration. I propose to treat each of these different heads of ore dressing separately, but first let us examine into, and compare in a general way, the two systems of air and water dressing.

AIR SYSTEM.—For the last 15 or 20 years great efforts have been made at different times to introduce machines for dressing ores in a dry state, but up till very lately they have always been attended with but very poor success, and in my opinion it is not likely that this system will ever take the place of water dressing. Of course in some countries where water is a scarce article, or where in winter the water supply is closed up by frost, a good dry concentrator would be an invaluable boon to the miner, and would enable some mines to continue work which are now closed. Such cases, however, are very few and far between. A mine is seldom so dry as not to furnish water enough for dressing, even should the surface supply be limited, and then such mine water would seldom, if ever, freeze before its arrival at the surface and its utilisation in the washeries. The advocates of the dry system maintain that a very large percentage of the fine ore is lost if once wetted, as it is so light as sometimes to be carried for miles down a stream. This certainly is true in some respects, but a far larger amount is lost generally by the dry concentrators beyond any power of catching, besides it having a very deleterious effect upon the lungs of the unfortunate workmen. There certainly are one or two exceptions to this, which I shall describe further on, where a provision is made for catching this impalpable dust, one of which I really think may prove a boon to many dry mines. Another drawback, and by no means a slight one, to this system is the fact that all ores *must be thoroughly dried* by some mechanical means before they can be treated. This becomes a very expensive item where large quantities are handled. Even in tropical countries it is seldom that the sun can be relied on for drying, and therefore the whole system has to be carried out under cover, and either steam or direct firing used. On the other hand it is truly advocated that the ores once dried are easier packed, and a great saving is also effected in transportation, but that scarcely compensates for the first expense of drying the whole mass of stuff, tailings, and ore.

Most patentees of air concentrators maintain that a more perfect separation must take place in air than in water, the lesser density of the air causing the machine to be so much more delicate and sensitive in its operation than it would be if working in water. This point, however, is just where most our concentrators are at fault. The particles held in suspension by the column of air fall through it so quick as scarcely to have time to separate according to their specific gravities, and therefore in order to obtain a separation they have to be lifted again and again. A good separation may at last be obtained, but at such a slow rate that all profits which might accrue through a saving of water, or even of a certain percentage of ore, are counterbalanced by the expense of working.

WATER SYSTEM.—This system of mechanical preparation is so universally in use as to scarcely necessitate anything being said in its favour. Its chief advantages are—1. The thorough cleansing of the ores to be treated from all foreign and earthy matters with which they are very generally mixed, and causing therefore a perfect disintegration of the whole mass. By this means each particle of ore is able to class itself at once by its gravity, and is neither buoyed up nor weighted down by foreign matter, as is sometimes the case in the dry process.—2. The great accuracy with which the grains of ore can be at once classed according to their specific gravity.—3. The facility with which a large portion of the fine tailings are carried away and deposited at some distance from the works, with but little or no manual labour. It is said that a large percentage of the fine ore is also carried away with the current. This is, in a great many instances, really a fact, but by a little good management and care it may be partially avoided, if not entirely so. Farther on, when speaking of slime dressing, I shall endeavour to point out in what way nearly the entire amount of ore may be profitably collected when it is not chemically combined with its gangue. This latter fact, which has lately been called to my attention, has been much overlooked. There are many gangues which are impregnated with the mineral salts to the extent of 10 or 12 per cent. of their weight, and this will account for the apparent enormous loss of metal even in some of the best devised and administered dressing-floors. In the same manner I have often found a discrepancy between the analysis of mine stuff and the same ore after concentration, when to the eye, and even under the microscope, the tailings have contained no trace of ore.

E. G. SPILSBURY,
*New York, Feb.* 27. Civil and Mining Engineer.

## GEOLOGY OF SIAM.

SIR,—If "K. L." will read M. Mohot's work on Siam, he will find the natives are friendly to Europeans and thousands of Chinese scattered throughout the country, and what attention is given to the passport of the Siamese Government by their rajahs. Any person interested in the country will find M. Mohot's illustrated work well worthy of their attention. Although he does not speak of the geology of Siam, yet his notes on the various interviews he held with the head men of the country will assure him the native tribes are friendly towards Europeans and Chinese. Mr. Alfred R. Wallace's Journal on the Malay Archipelago will give the clearest and most distinct idea of the health Europeans generally sustain in the East Indies. TIN.

## MINING IN NEVADA.

SIR,—In reply to the letter from Mr. J. E. Bowe, which appeared in the Supplement to the Journal of Feb. 18, the agents who inspected Bateman's Eureka or Champion Mines with me were Capts. Brown and Reseigh. I deny that Capt. Scaddon was in that inspection with us. We had left the neighbourhood of the mines before we knew that Capt. Scaddon had been employed to inspect. His inspection was quite independent of ours, and he sent his own telegram and report. The statements made by Mr. Bowe and other Americans do not prove anything, and must be regarded as mere statements only. In his letter above referred to he says—"The Champion Company lost a property which was offered at 50,000*l.*, which is selling to-day in San Francisco at the rate of 200,000*l.*, and is now paying dividends at the rate of nearly 500*l.* per cent. per annum upon the price at which Mr. Batters and his associates were to get the property." Mark what Mr. Bowe says—"now making dividends." I find, in the Supplement to the Journal of Jan. 28, that another party—who, however, does not give his name—and referring to Bateman's Eureka, states—"A profit of 10,000*l.* as the result of fourteen days' work is not a bad return, especially when it is remembered that the mine is doing this month by month." These profits would be good enough if realised—but are they true? Has any dividend ever been declared out of these enormous profits? I reply for these American mine-sellers that no dividend has ever yet been declared in Bateman's Eureka, and I have it by the last California mail from parties whose truth and honesty cannot be questioned. No doubt this will be denied, but the readers of your valuable Journal may rely upon it as a fact. The shareholders are highly indignant and disappointed, and the stock has already fallen 30 to 40 per cent. I am also assured there never was anything but a nominal market for the shares.

Where, then, is the 500*l.* per cent. dividend which Mr. Bowe speaks of? Messrs. Allington, Scaddon, and Nancarrow say it is a rich property. The mine has been working eight months, and, according to their own statement, profits have been realised amounting to 10,000*l.* month by month. I will ask any sane person whether he can believe such statements when no dividend has ever been declared? Mr. Allington is made to say he shall take as large a holding as he can whichever party gets possession of the property. Allow me to ask if Mr. Allington took a single share in the present company, and whether he has received any dividends? If I am correctly informed, he never took a share.—*Newtown, Montgomeryshire, March* 15. F. EVANS.

## MINING IN SWEDEN.

SIR,—I read the frequent communications of your correspondent who subscribes himself as of "the Sulphur Mines, Norrtelje, Sweden," which appear in the Journal. It would seem to anyone well acquainted with the mineral and other resources of that kingdom that from some cause or other the writer occasionally fails to convey an exact representation of the facts adverted to—as, for instance, he observes (in the Supplement to last week's Journal) that the Government are just now awaking to the vast importance of extending railway facilities in various directions for the development of the mineral resources of the country, and that it is only the want of an abundant supply of the "black diamond" which will prevent the ironmasters competing successfully in the Russian market as against the English producer. Now, in reference to these points, I would venture to submit that it is a well-known fact that English coals are as cheap at Gefle, near the immense iron fields of Fahlun, as at London, and it is also a fact that at any port on the Baltic shores of Sweden Swedish coal can always be placed at a much cheaper rate than English coal, which native coal, whilst available for smelting, is alike valuable for railways, gas manufacture, and household purposes—of which facts your correspondent would appear to be entirely ignorant. In confirmation of the foregoing, I may add an extract from an official document furnished to and published by the public press in Sweden of that date—February, 1866 :—

"This coal must also, on account of its containing little sulphur, be greatly preferable to English coal in the manufacture of iron."—Signed at Helsingborg, Feb. 7, 1866, by C. W. Blomstrand, Professor of Chemistry and Mineralogy at the University of Lund ; George Gustafsson, Government Land Surveyor ; and N. Fr. Frykholm, Government Superintendent of Railways.

Your correspondent, perhaps for some reason, fails to admit the fact that the non-development of the vast mineral and other treasures of that kingdom has arisen chiefly from the inherent independence of the Swedish nation of foreign capital aid, and hence, whilst few lands can, perhaps, compare with Sweden in the material resources which commands a nation's greatness, those vast treasures may continue unchallenged by scientific industry, enterprise, and research, involving incalculable national loss to all posterity.

Having at different periods visited and inspected many of the most important mineral districts of Sweden, I propose, with your permission, to contribute a few articles on the mineral resources of the country generally—commencing with the Swedish coal fields, their extent and value, with official statistical and other reports thereon.

27, *Leadenhall-street.* WM. SYNNOCK.

## MINING IN CARDIGANSHIRE AND MONTGOMERYSHIRE.

SIR,—Having been accidentally called to the little but nice hamlet of Talybont, the first thing that attracted my attention was a powerful water-wheel. To serve my curiosity, I turned into a spacious yard where the wheel was situated, and while I was examining the machinery, which was cleaning the silver-lead ore (they called it the self-acting dressing machinery), out came the captain of the mine, who appeared very civil and courteous, and showed me all the different departments of the dressing-floors. I was informed that the credit of the construction of the machinery is due to the manager of the mine, Mr. Green, of Aberystwith : be that as it may, the invention is the best I have seen, and by which three-fourths of the ordinary price of dressing ore is saved. As a matter of course, I went over the mine, and was quite astonished to find that such a property as this (ALLT-Y-CRIB) has been almost totally neglected until the last year or two. It is now, however, in the hands of a party who know its value, and they are developing it rapidly, and when they reach the western part I have no doubt it will turn out as rich as the eastern part had turned out to Sir Hugh Myddleton. From there I was directed to another mine, which I believe sprung up on the faith of the above, and a rich lode has been found there—in fact, seldom can any person on a tour of inspection be lead to a place where a finer heap of ore stuff can be seen than at NORTH ALLT-Y-CRIB. Capt. Charles Williams is entitled to the credit of this valuable discovery, and I think he is the manager of the mines.

The next day I determined to visit the BLAEN CAELAN MINE, and was pleased by the prospects of the sett, which bids fair to rival any in the county. Great credit is due to Mr. Balcombe and his agents for the grand discoveries made here, and the economical arrangements made to carry on the workings. Finding by my guide there was an EAGLEBROOK further south, I took to the road, and soon found myself there. This mine has been worked for many years with a loss, but by the present appearance and returns of ore now made monthly, it will soon return the whole outlay. About a mile further south is the celebrated HAVON AND HENFLWCH MINE, which is (if I am properly informed) managed by Capt. Roberts, who also is manager of Dyfngwm Mine. All I know about this old mine is that I have in former days seen a splendid lode there, and that hundreds of tons of ore have been sold to a great profit to the company. However, they failed, and the mine was abandoned ; about a year since a few gentlemen restarted it, and worked without any prospect of success, but in a short time Capt. Roberts was employed as manager, and he soon made a very important discovery in the north side of the adit level ; I was told he tried it down in the side of the 10, and found it to yield 8 tons of silver-lead ore to the cubic fathom. It appears that this extraordinary course of ore is unwrought up to surface about 30 fms., and down to the 30—the bottom of the mine. The 20 east has been driven on the south of the lode by former workers, which has been now properly directed, and will, as I was informed, produce 3 tons of ore per fathom, and then the lode was not cut through ; as a general rule, in this mine the best part of the lode is on the north side, so it is likely enough that this part will prove as productive as the first discovery I mentioned in the adit level. I cannot refrain from saying, fortunate Havon and Henflwch Company ! No doubt this mine will find its way to the list of the Dividend Mines in a very short period from this date, to the pleasure of the manager and the benefit of the proprietors.

The next place of note is the CAMDUR MAWR MINE, on the celebrated Bronfloyd, and on one of the Dyliffe Mine lodes, which is now in the hands of a few working miners, who are unable to do much by it, but unless some energetic party will take it in hand it is to be feared that the principal wealth of this famous lode will have to rest for some time to come. There are several other places in this vicinity which have been almost totally neglected, worthy of the notice of capitalists. I may have occasion to call by this way on a future day, when I expect that several good paying mines will be firmly established. In order to give the public an idea of the situation of these mines, it is proper to say that it is in almost virgin ground to the east of the Cardiganshire mines, and to the west of the Montgomeryshire mines, and no doubt there are as good mines to be met with in this district as any found in either of the counties mentioned. J. A. W.

## SOUTH CONDURROW MINE, AND THE LATE DIVIDEND.

SIR,—Why an "Investor," who hails from Truro, should be so strangely anxious for "shareholders in this undertaking to hold on their shares," may possibly be enigmatic to some of your readers. It is not often that one finds such utter self-abnegation—such unadulterated disinterestedness. The ordinary investor, having satisfied himself as to the character of his investment, would rather see his co-proprietors realise, because, as a man of business, he knows that others selling enable him to increase his stake at less market prices. Not so, however, with the "Investor" at Truro ; he abnegates his own interest in favour of others, who, of necessity, are perfect strangers to him. "Wait," says he" the further development of the mine." Why ? Surely not to afford "Investor" the first opportunity of realising at the present high prices.

How strangely, too, the advice "to hold on the shares" contrasts with the more practical and certainly the more truthful statement made in your City Article last week in reference to the unsatisfactory position of the accounts. If it be true (as one of your correspondents affirms) that at the recent meeting credit was taken for tin sold up to the last moment, and costs are charged up only to the end of November, it is not difficult to comprehend the fear evinced by "Investor" that, notwithstanding all his efforts to uphold the price, after all he may be left behind.

When will those entrusted with the financial administration of cost-book mines begin to be alive to the vital importance of submitting fair and candid accounts ? Do they know the incalculable injury they are doing to the interest of mining in the eyes of the public by declaring dividends when there are unliquidated liabilities ? The effect of the dividend recently declared at South Condurrow was to cause the shares to decline in value 1*l.* per share, which is the best answer as to the views entertained by the shareholders. Doubtless I may be told that those entrusted with the management have nothing to do with the price of shares. If such be the case, what object can there have been in recommending the declaration of a dividend when the amount should have been set against incurred expenditure, yet to be defrayed. Moreover, is not this step a direct infraction of the provisions of the Stannary Amendment Act, although a pleader in that Court recently stated, in connection with the Clifford indebtedness, "that it was usual for cost-book accounts to be in arrear ?" Is there not some penalty attaching either to the declaration of a dividend when costs are undefrayed, or to the suppression of unliquidated liabilities ? Does it not occur that these momentous questions should be duly considered by "Investor," who is desirous that shareholders "should await the further development of the mine ?"

*Camborne, March* 14. FECIT.

## NEW EAST LOVELL MINING COMPANY.

SIR,—From the Journal of the last two or three weeks I have been glad to see that some of the shareholders in New East Lovell are giving signs of their dissatisfaction at the questionable manner in which the mine is being conducted. The meetings are the most unsatisfactory gatherings of the kind that I have ever read about, showing plainly enough, as suggested by one of the correspondents in last week's Journal, that some two or three individuals have it all their own way. For some reason or other the East Lovell lode they made so much fuss about some 12 months since is quite a dead letter at present ; and from what I have heard about the mine they seem to be like so many rabbits burrowing and scratching here and there, without any tangible aim or purpose whatever, instead of prosecuting their researches on the East Lovell lode alone. If they have found such a lode I should be much obliged if some one interested would state in the Journal the number of cubical contents of material excavated up to this time, as I wish to compare it to the amount of money called up since the mine started, and I have no doubt but a great many of the shareholders would be glad to know as much as well as I.—*Manchester.* ANOTHER SHAREHOLDER.

## THE TAQUARIL GOLD MINING COMPANY.

SIR,—It is not easy to discover the reason which induces our managers in Brazil to forward by one mail the most unqualified statements as to the great value of our mine, and within a few weeks afterwards statements equally discouraging and gloomy—so completely so as to dissipate the hopeful anticipations of the most stedfast shareholders, and moreover to make any prudent man pause before again accepting anything emanating from Capt. Thomas Treloar, although prefaced with the now proverbial words "from ocular and tangible demonstration." In the present uncertainty, caused by the contradictory character of the reports from "that great authority upon jacotinga mines," as our Chairman has so often pleased to designate Capt. Thomas Treloar—an uncertainty, I may add, considerably increased by the eagerness with which those behind the scenes have disposed of their interest—in this uncertainty, I ask, is it not the duty of those who still remain shareholders—those, in other words, who pinned their faith upon the reputation accorded to Capt. Thomas Treloar by our Chairman—to band ourselves together and sift this at present inexplicable matter to the core ? True, no one can prevent certain bankers in Cornwall selling shares, but when it is believed—if, in fact, it is not known—that those shares were acquired for, and subsequently sold for, parties who are not 1000 miles from Taquaril, surely an explanation of the two statements made by Capt. Treloar in September "that from ocular and tangible demonstration he was justified in stating that Taquaril is the richest gold mine in Brazil," and those made two months afterwards by Mr. T. S. Treloar, is imperative.

In the event of no step being taken in this direction in the meantime, I shall most certainly (as a matter of duty to myself) move for the appointment of a committee of investigation at the ensuing general meeting, for it is too monstrous to suppose that we are to submit to pay heavy, if not extravagant, salaries to be at one moment led to believe—nay, told most positively—that we do actually possess "the richest mine in Brazil," and within a few short weeks to be dismayed by intelligence than which nothing could possibly be more disheartening, more discouraging. Clearly, we have been misled, either in expecting too much or too little, for certainly "the richest gold mine in Brazil" cannot become the poorest in something less than eight weeks.

Is it not possible to have our mine inspected and reported upon by reputed practical authorities in Brazil—men above suspicion and reproach ? If it can be done, and I really see no reason why it cannot, I will most cheerfully subscribe my quota towards the expense, although a—

*March* 14. HOLDER OF MORE THAN ONE THOUSAND SHARES.

[For remainder of Original Correspondence see to-day's Journal.]

CRUSHING AND GRINDING MACHINERY.—The invention of Mr. G. H. GOODMAN, of Penrose-street, Newington, consists essentially of a horizontal ram, the head, or acting face of which is curved and serrated obliquely ; through the head of the ram there is a horizontal bos, or hole, through which an eccentric is made to pass loosely. The journals of the eccentric have their bearings in the cheeks or sides of the main frame of the machine, and the eccentric being put in motion by suitable gearing a kind of rolling motion is given to the ram, which at one and the same time both crushes and grinds the material being operated upon. Opposite the face of the ram is a fixed block, also serrated obliquely, and in an opposite direction to those on the face of the ram. The tail or back end of the ram is made with a slotted or forked end, in which a sliding bearing is made to work loosely, and the journals are stayed by bearings, securing equilibrium to the working of the ram. The crushed material passes through a vibrating sieve, with a shute for the purpose of conveying the material to the amalgamating dish. The triturating mill is of improved disc construction, and arrangements are made for facilitating the renewal of the parts most exposed to wear. There is also a contrivance to admit coarse material into the discs, which consists of two movable serrated conical rings ; there are also moveable furrows. By this means the coarse material is reduced to powder in passing through the mill, and finally thrown into the amalgamating dish. This has two compartments, similar to two dishes placed one within the other, and the outer dish, which contains the quicksilver, is at all times kept flowing over with water. The ore under treatment is constantly stirred into the mercury by an arm attached to the revolving part of the triturating mill. The novelty claimed for the machine is that the jaw is worked direct by the eccentric, and that it is thus given an up and down as well as a to and fro motion ; and it is stated that the first cost is less than that of other machines of a similar kind.

CRUSHING MINERAL AND OTHER SUBSTANCES.—By the invention of Mr. J. WITHINSHAW, Birmingham, the framing of the mill is supported upon four or other number of fixed supports, the summits of which are made into pistons. The bases of the four uprights of the framing are made into short hollow cylinders which fit upon the pistons of the said fixed supports. The four uprights and the cross-head joining them are hollow, and when the said hollow framing is filled with water under pressure, the said framing and all the parts of the mill except the fixed supports are supported on the water between the pistons of the fixed supports and the tops of the cylindrical bases of the said uprights. Any increase in the quantity of water forced into the said cylinders causes the whole mill to rise, and any diminution of the said water allows the mill to descend. The table or platform on which the matter is to be crushed is placed has a rotary motion given to it by suitable gearing from a small steam engine or other motive power engine.

APPARATUS FOR FORCING AIR.—The invention of Mr. W. COWLEY, Liverpool, consists of a pair of cylinders, each of which is, by preference, formed in two parts, with annular external flanges at each end for joining the two parts together, and by attaching the covers thereto by screw bolts and nuts, or in any other convenient way ; each cylinder is fitted with a circular and slightly conically tapered bag, the sides of which are formed of india-rubber, leather, or other suitable flexible material or combination of materials, and the bottom by a rigid annular piston of somewhat less diameter than that of the interior of the cylinder. These bags, which when in position are of slightly less depth than the length of one of the sections into which they are introduced, are securely held by their upper edges between the flanges by which the two portions of the cylinders are connected. The pistons forming the bottoms of the bags are in some cases fitted with hollow piston rods, which slide on fixed bars projecting from the cylinder covers on the reverse ends, and working through glands on the opposite covers.

## BOILER EXPLOSIONS, AND THEIR PREVENTION.

That accidents from boiler explosions are altogether preventible is not pretended, but it is very generally considered that by watchfulness and attention the number may be materially diminished. At a recent meeting of the Institution of Mechanical Engineers Mr. EDWARD B. MARTEN read a valuable paper "On the Conclusions derived from the Experience of Recent Steam Boiler Explosions, in which he gives an analysis of the explosions in the last four years, showing the causes of explosion of each form of boiler, and also a summary of the causes of explosion under the three general heads of —faults of construction and repairs, faults in working which creep on insidiously and unnoticed, and faults which might be seen and guarded against by careful attendants, and contends that nearly the whole of the faults in these three classes would have been detected by periodical examination. The causes of the accidents seem to have been very various, and Mr. Marten classifies 95 as resulting from faults of construction or repair, 62 from faults to be detected only by periodical examination, 54 from faults which should be prevented by careful attendants, and 8 from extraneous and uncertain causes, and with reference to some of these he gives some very interesting particulars. As each remarkable explosion is illustrated by an engraving of the fragments of the exploded boiler, it would of course occupy too much space to refer to the whole of them, but we may mention a few of the principal ones.

Although the importance of periodical examination as the best safeguard against explosion is, as Mr. Marten remarks, generally admitted, a great number of those who make or use boilers have not at present sufficient belief in its importance to adopt this course. Boilers are still constructed or set in such a manner as to render examination next to impossible, and are continued to be worked without making it the duty of those who mind them, or of anyone else, to examine every part at frequent intervals, and hence preventible explosions occur. It is thought by many steam users that all has been done which is possible if their boilers are the best that can be procured, and are set in the most approved way, and it is taken for granted that such boilers should last for many years, under the idea that a good boiler can never explode unless the feed is neglected. Similar boilers are often referred to as having worked safely for ten or twenty years, but it is forgotten that they may be exposed to the insidious action of furrowing on the inside, or channelling on the outside, so that explosions of originally good boilers may possitake place. Much mischief, again, arises from special classes of boilers, fittings, or apparatus, being looked upon as promising permanent safety from explosion; while the inevitable circumstance is overlooked that it is only so long as everything is maintained in good condition that safety is ensured. An apparatus, for instance, for preventing explosion from shortness of water or over-pressure, however perfect for any such object, would be quite inefficient as a safeguard against explosion from corrosion, furrowing, channelling, or weak construction. It is curious to note how often it is the case that every other part of an establishment is subject to severe and perpetual scrutiny, the engines especially being overhauled with the most scrupulous regularity; while the boilers, the very source of the power and the heart of the whole business, are left to themselves for long periods, even for years, without examination; and it is too often only after bitter experience that owners have understood the need of this examination. In this, as in many other matters, experience has shown that there is no royal road to safety, and that immunity is only secured by unremitting care and constant watchfulness. It should never be forgotten that even a good boiler can explode; for however good at the outset, sooner or later the time must eventually arrive when such wear and tear will have taken place as will result in dangerous weakness, unless the boiler is carefully and systematically attended to. Although a boiler may even last safely for 10 to 30 or more years if worked slowly and with care, no confidence can be placed in a boiler which has worked so long, unless it is examined in every part.

Fig. 1.—Plain cylindrical boiler, easy to examine.

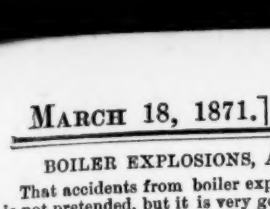


Fig. 2.—Cornish boiler, awkward to examine.

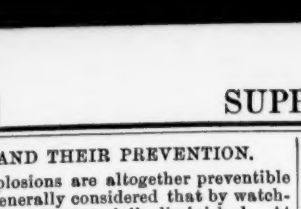


Fig. 3.—Lancashire boiler, with narrow flues,

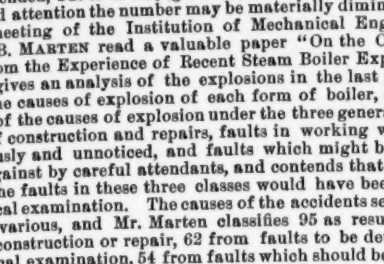


Fig. 4.—Lancashire boiler, narrow flues.

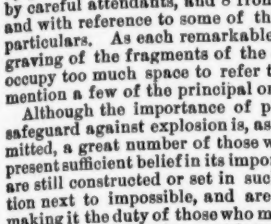


Fig. 5.—Lancashire boiler, wide flues.

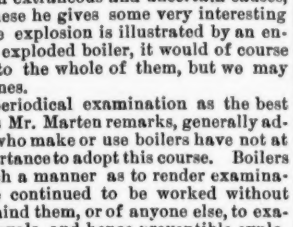


Fig. 6.—Lancashire boiler, wide flues.

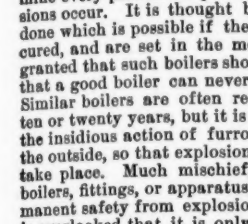


Fig. 8.—Cornish boiler, with sight-holes in flues.

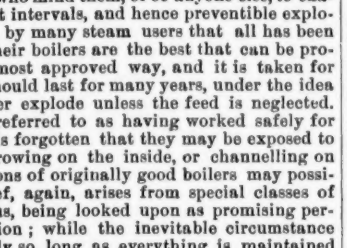


Fig. 7.—Lancashire boiler, narrow flues.

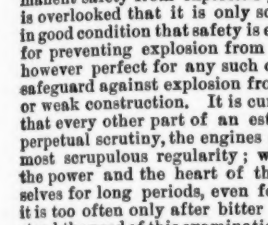
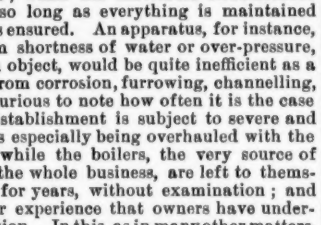


Fig. 9.—Cornish boiler, with sight-holes ih flues. Plan.



In order to enable boiler minders to make proper periodical examinations, it is necessary that care should be taken to arrange both the boilers and the flues with that view; and this can be done without materially injuring the efficiency of the boiler. Ordinary plain cylindrical boilers can be entered easily (Fig. 1), and although the small spaces between the tubes and the shells of Cornish and Lancashire boilers (Fig. 2) render the complete examination troublesome; there is no difficulty in seeing those parts most likely to need examination, such as the crowns of the tubes, and the end plates and angle iron. In the external flues greater accommodation is needed, as in many cases these are so narrow that the boiler is inaccessible without pulling down the brickwork (Figs. 3, 4). The loss of heating effect caused by the use of wider flues is so little that it is far outweighed by the greater security obtained from the more efficient examination that is thereby rendered practicable. The flues of the plain cylindrical boilers are easily made wide enough for a man to pass through them. The flues of Cornish and Lancashire boilers should be made as shown in Figs. 5 and 6, so that a man can enter them without such inconvenience as in Fig. 7. One point of danger being the use of wide mid-feather walls, on which corrosion is apt to take place; these should be narrowed, and the weight of the boiler supported on side brackets; the top of the mid-feather and side walls can then be constructed with sight holes, as at A.A. in Figs. 8 and 9, so as to give the means of examining the plates near each seam by simply removing loose bricks.

With regard to the nature of boiler explosions, Mr. Marten explained that in ordinary boilers there is present besides the steam a quantity of water heated much beyond the atmospheric boiling point, and when rupture takes place, and the pressure is suddenly relieved, part of this water evaporates and keeps up the supply of steam to continue the rupture and destruction. The explosion of a boiler differs, he contends, from the discharge of electricity or lightning, which cleaves the air and instantly leaves a vacuum; it also differs from the discharge of detonating compounds, which act suddenly and leave a vacuum; but it more nearly resembles the discharge of gunpowder, which burns sufficiently slowly to keep up a continuous pressure behind a projectile until it leaves a gun, and each cubic foot of water in a boiler working at 60 lbs. pressure has been shown to produce in steam an explosive effect equal to 1 lb. of gunpowder. None of the elaborate but unlikely theories of decomposed steam, or of electric accumulations, suppose a force so fitted to cause destruction as that contained in the highly-heated water existing in all working boilers. Perhaps no boilers have worked for a greater number of years than the plain cylindrical boilers, many specimens being in existence and apparently in good order which were put to work 50 or 60 years ago. When such boilers have been too much or injudiciously repaired they are treacherous and uncertain; but their rupture and explosion occur not so much on account of fault of shape, as from the simple reason that, like willing horses, they are easily overworked. The grates are usually twice as large as the fair proportion to the heating surface, producing the double evil of forcing more heat through the iron plates over the fire than they can transmit without injury, and allowing a great amount of heat to pass away to the chimney without useful effect. Careful experiment shows that nearly as good duty can be obtained with the plain cylindrical boiler as with any other form, provided the rate of combustion is in fair proportion to the extent of heating surface in the boiler. The circumstance that many plain cylindrical boilers have exploded is not sufficient to condemn this make of boiler, which is the cheapest, simplest, and most easily set. If the number of explosions alone were to be taken as the guide, it would lead to the condemnation of the Cornish and Lancashireboilers, from the experience of the past four years. But in the case of both plain cylindrical and other forms of boilers, most of the dangers admit of remedy, and can be guarded against by frequent examination.

Referring to the merits of compositions for the prevention of boiler incrustations, Mr. Marten remarks that much mischief is often done by their injudicious use, especially where there is no blow-off cock, or where its use is neglected. A hard deposit on the boiler plates is, in his opinion, not so injurious as the soft and muddy deposit produced by the use of such compositions. A hard scale is equivalent to thickening the plate, and although this is sufficiently mischievous the injury to the plates is much more rapid when a thicker but spongy deposit entirely prevents contact of the water, and impedes the transmission of the heat. The money spent in boiler compositions would, he thinks, be better applied in securing a supply of proper water, or in filtering and purifying the water before it enters the boiler. Mr. Marten distinctly wishes it to be understood that he does not infer that all boilers are working in actual danger. A very small percentage, perhaps, are so; but without periodical examination no one can feel sure as to the condition of any boiler. It is not likely that explosions in future will be from exactly the same causes as those he has described, because the known faults will be avoided. For instance, no new balloon, wagon, or Butterley boilers are now made, and the peculiar faults and the weakness of the tubes in Cornish and others of the better classes of boilers are now so well known as to be generally avoided; and as information spreads, many evils will become things of the past. The general conclusions to be drawn from the records of boiler explosions appear to be—that the force accumulated in an ordinary boiler is enough to account for the violence of an explosion; that no form of boiler, however well constructed and fitted, is free from the liability to explosion, if allowed to get out of order; and that boilers which bear the hydraulic test may still be dangerous; that the condition of a boiler can be satisfactorily ascertained only by periodical examinations, and that no boiler should work without being thoroughly examined at short intervals; that the cost of periodical examination is so little as to be far outweighed by the greater security obtained, and that the settings of all boilers should be constructed with a view to facilitate examination; and that the surest way to make systematic examination general is to spread as widely as possible correct information as to the facts and ascertained causes of boiler explosions, and to inform boiler owners and minders what dangers to guard against; and that this is preferable, and more likely to lessen explosions than enforcing any system of inspection by legal enactment.

## SUCCESSFUL APPLICATION OF COMPRESSED AIR MACHINERY TO COAL MINING.

The most successful application of the pneumatic or compressed air principle in the performance of the mechanical work in coal mines is now to be seen at the Holmes Colliery, near Rotherham, the property of the Rotherham, Masborough, and Holmes Colliery Company. Mr. PHILIP COOPER, the well-known mining engineer, and manager of the colliery, has for some considerable time been engaged in making a series of experiments in order to ascertain the extent to which the compressed air system could be applied. He has been so far successful that water is now being pumped from the pit, and coal hauled along the tramways by means of power obtained from compressed air. The air is compressed on the surface by a doubled-cylindered steam engine, with 18-in. cylinders and 3-ft. stroke, with two air-compressing pumps, 20 in. in diameter and 3-feet stroke, worked direct from the steam-engine. Near this steam-engine is placed a large air receiver, while corresponding with this, in the mine at a distance of nearly one mile, are three receivers connected by short cast-iron pipes, so as to form one, this plan being found necessary in order that the receivers could be made on the surface and connected in the pit without rivetting, as safety-lamps are exclusively used at the colliery. At this part of the mine also is an air-engine, with two cylinders, each 14 in. diameter, with a 12-in. stroke, working two double-acting force pumps, 5 in. in diameter, with a 12-in. stroke. The compressed air is conveyed from the compressing engine on the surface to the air-engine in the mine in 7-in. cast-iron pipes; the discharge pipes of the pumping apparatus, worked by this compressed air, are 5 in. in diameter, and nearly 1000 yards long, having a vertical lift of nearly 100 yards. The apparatus was first worked on Jan. 6, and the steam-engine was worked at the rate of 50 strokes per minute, a uniform pressure of 25 lbs. per inch being maintained for eight hours at the surface and at the underground receiver. The air-engine was worked during that time at the rate of 50 strokes per minute, 160 gallons of water per minute being raised. Since that time the results have been even more satisfactory, the apparatus working in even a better manner than anticipated.

Encouraged by this success, Mr. Cooper turned his attention to adapting the compressed air system to the hauling of coal, it having hitherto been found impossible to accomplish this kind of work by water power, and steam also having failed through the great difficulty experienced in economically conveying it long distances or safely placing steam boilers underground. After a variety of experiments a successful result was again obtained, and coal is now daily being hauled by means of power supplied by the air-engine. Many experiments have been made in various parts of the country to apply this principle of working by compressed air in coal mines, the result in the majority of cases being that it was found that a loss of about 75 per cent. of the power was sustained in the transmission of the air from the compressing engine on the surface to the air-engine in the mine. Mr. Cooper has ascertained that this loss of power arose from the fact of the pipes employed to convey the compressed air being of much too small diameter, and the result of his experiments has convinced him that with a sufficiently large air-pipe a power equal to 100 horses can be very economically transmitted to a distance of 1 or 1¼ mile, where it can be used for all the purposes to which steam and horse power is now generally applied, such as pumping water in the dip working of the mine, working coal-cutting machinery, lifting or hauling coal, and in tramming it along the ordinary bank levels or ends. Another advantage is that when not needed the compressed air, unlike steam or water, can be allowed to escape into the workings of the pit with a result beneficial rather than otherwise.

Nor need the principle be confined to coal mining, for Mr. Cooper suggests that it might be extensively and economically applied in large towns requiring mechanical power at many different places, if laid on in the streets the same as gas or water, and the pressure produced at some central station. A series of experiments are now being made at the Holmes Colliery in order to ascertain the relative power required for compressing the air and that given out by the air-engines, under different conditions of velocity of both steam and air. The introduction of this principle at the Holmes colliery is exciting great interest in the South Yorkshire mining district, and on Thursday a large party of scientific and other gentlemen interested in coal mining visited the colliery to inspect the new machinery now laid down.

## THE SOMERSETSHIRE COAL FIELDS.

### THE SOMERSETSHIRE COAL CANAL COMPANY, AND CHARLES HOLLWEY, PROPRIETOR OF THE CLANDOWN COLLIERY.

This was an important case, involving the liabilities of coal proprietors for conveyance of coal, heard in the Bath County Court, before his honour Judge Caillard. Mr. Webster, barrister-at-law (instructed by Mr. T. W. Gibbs, and Mr. G. H. Cook) appeared for the company; and Mr. Finlay, barrister-at-law (instructed by Messrs. Stone, King, and King, were for the defendant.

In opening the case Mr. Webster said the total claim amounted to 379l. 3s. 3d., due to the proprietors of the Somersetshire Coal Canal Company as tolls for carriage and passage along their canal. The company was incorporated in 1794, under an Act of Parliament, entitled 31 George III., c. 86, for making, maintaining, and navigating a canal which had way-leave to certain collieries in Somerset. It was manifest from the whole tenor of the Act that its intention was to enable the proprietors to open up the Staffordshire coal fields, and giving them free and complete communication with the Kennet and Avon Canal. It did not at all contemplate local traffic, and the canal was not constructed with that view. The canal began at Dundas, went as far as Midford, and there it divided into two branches, one going to Timsbury, and the other to Radstock. The latter was the branch with which the present case dealt, and was originally constructed as a canal; but before the whole of the undertaking was completed is was turned into a tramway, or, rather, a tramway was laid along the towing-path, because the nature of the soil was such that the water would not stay, and the use of the canal as such was impossible. This conversion into a tramway was done with the co-operation of the whole of the coalowners at the time. Defendant's coal pit, whence came the coal about which there was the present contention, was the Clandown pit, north-west of Radstock. By the 126th section of the Act it was made lawful for the lords of the manor and landowners to erect wharfs along the canal, but from 1794 to 1856 no wharf was made, except at Midford, where the coal coming down was tipped into the barges. During all that time the district was entirely worked by coal passing down the whole length of the canal, and the Act fixed certain tolls per mile upon the traffic passing down the whole length of the main canal. On reference to the first and second sections it would appear that if the company were called upon to make branch trams from the canal the colliery proprietors were to guarantee a sufficient amount of coal to come down such branches as would produce a quantity equal to the general dividend of the company; and, if the tonnage did not prove enough, to pay such a sum as would equal it. From 1794 till 1856 no local traffic existed upon the canal, but in 1845 the Wilts and Somerset Railway Act was passed, and in 1856 the Radstock station was opened. It became at once apparent that there would be a large opening for trade by the Great Western Railway by the new station, and deputations of colliery proprietors held negociations with the company on the subject, asking them to provide outlets from their main tramway, to communicate with the Wilts and Somerset Railway. In complying with this wish the company were giving up their through traffic, as the coal sent to the Great Western line at Radstock, if accommodation had not been provided, would have continued to go over the whole of their canal. Accordingly, it was found that on October 2, 1856, the following minute was entered in the company's books:—"The engineer's report of Oct. 1, 1856, was read and approved. As regards the portion relating to the Writhlington railroad, it was resolved that a siding be constructed, and a toll of 5d. per ton be required from all parties who choose to carry coals and other materials over the same." The coal thus passing did not go above half a mile on the main tramway, so that the actual toll on the main tramway would not pay the 5d. Immediately afterwards there came deputations from the colliery proprietors, amongst others from the then proprietors of the Clandown Colliery, representing that the amount originally charged was too heavy. In 1856 Mr. Hollwey, the present defendant, was the manager of the Welpton Hill Colliery, and he and Mr. Thomas Cottle, the then manager of the colliery of which the defendant was now the proprietor, had an interview with the engineer, to discuss the question of making the siding relating to the present action, and it was then pointed out to them that the Clandown Colliery was the only one that was making arrangements, or was likely to use the siding in question.

Mr. Finlay said he did not admit that his client was cognisant of any arrangement previous to his connection with the Clandown Colliery.

Mr. Webster, resuming, said there was this minute on the company's books:—"A letter from the Clandown Coal Company was considered. It set forth the objection of that company to the rate of charge at 5d. per ton, and requested a reduction. The members of the committee present were of opinion that the rate of charge was too high, but were not desirous of altering without the presence of their colleagues;" and, afterwards, "Resolved, that such charge be reduced to 3d. per ton, till a junction should be formed between the tramroad and the Great Western Railway." Confirmations were forthcoming. There were seven pits that had ever since 1857 been sending their coal to the Radstock station by means of a turn-out, but the Clandown pit was the only one that used the siding in question, the Welpton pit using the Ludlow siding, a little further down. The 3d., then, represented the use of the special tramway constructed by the plaintiffs, and the right of going across the company's land, which was their private property. This continued without demur until 1869, when the lease of the Clandown pit was surrendered to Mr. Hollwey, on Feb. 19, although the plaintiffs were not aware of that fact for some time. As the defendant had, during the six or seven months which elapsed before he disputed the claim, tacitly acquiesced in the charges, sending his coal over the branch without objection, or giving the slightest intimation that he intended to dispute it, so that he was stopped from now disputing that 3d. was the proper toll. Owing to the coal passing off their premises at a point above where it was originally expected by the company there was no weighing machine above Mitford, and the colliery proprietors who had been provided with sidings had to make returns of the tonnage, and the amount which had passed over the tramway had been returned by defendant as 26,333 tons during the defendant's lesseeship, up to Nov. 17, 1870. A long correspondence ensued between Mr. Gibbs, the plaintiff's legal adviser, and Mr. Stone, the defendant's, in which the defendant said the plaintiffs had no right to charge him 3d. for the same tramway accommodation that they only charged Lady Waldegrave 1½d. for. This, indeed, was the only argument that the defence could adduce, that undue preference had been given. Such was not the case. In the first place, Lady Waldegrave's coal did not come out of the same turn-out as the defendant's. Nor were the other coalowners on the same footing as Lady Waldegrave, who had arranged for payment of 1½d. only in consequence of heavy claims and disputes between her ladyship and the plaintiffs. The Act incorporating the Canal Company contemplated no such accommodation as that for which the money was due, and that there was no section in it that could possibly be construed into an obligation of the kind. That argument was corroborated by the fact that for 50 years out of the 70 which the canal and tramways had been working no such accommodation had existed. The accommodation for which the amount was due was for an object altogether alien from the purposes of the Act, and by no means such as they would have had to supply under a writ of *mandamus*.

Mr. Samuel Dobell Mager, accountant to the company, Mr. T. W. Gibbs, the co-solicitor to the company with Mr. G. H. Cook, and Mr. Hill their engineer, by oral and documentary evidence proved the above facts.

Mr. Finlay for the defence said he would dispute the case on points

of law only, and would not call evidence. He submitted two points:—1. That if the plaintiffs could recover at all they could only recover according to the statutory rates.—2. That they were not entitled to recover anything, suing as a corporate body. The latter point he put on two grounds:—1. The making of the tramway was an enterprise altogether alien from the purpose for which the company was incorporated, and was carried out by them without statutory authority.—2. Assuming that the tramway was to be treated, for the purposeof this case, as a part of the canal they were authorised to make, they were only entitled to recover according to the statute the statutory rates, which rates, however, they had not proved. His learned friend had said that the Act of Incorporation never contemplated the local traffic, and that the canal was constructed purely for through traffic. He contended, in answer, that even if that were so it might have formed very good ground for an opposition on the part of the company to the Railway Bill, it would undoubtedly have furnished them with a good argument against the company; but they had no right, having allowed the establishment of a railway which injured their trade, to say that their returns were not sufficient to make the outlay profitable, and that they would by an exceptional rate make the returns larger. The returns of the tramway not being sufficient was no argument why they should use it to obtain rates in excess of the statute. The company having been incorporated under an Act of Parliament they derived all their rights and powers from that Act, and could claim nothing which is not given them by that Act. In fact, they were the creatures of the Act, and if they were not satisfied with the rates it gave them, and if it did not give them adequate return for their outlay, they could have made application to Parliament to amend their powers, but having exceeded their powers they could claim nothing that was incurred in consequence. He asked, what was the bargain made between the canal and the public? The first section of their Act of Incorporation showed that certain individuals were empowered to make and maintain a canal through a certain district, and also for making certain railways to collieries. The second section said that these railways need not be made unless the colliery proprietors would give an undertaking to the effect that if the tonnage did not yield sufficient to make the tramway pay a dividend equal to the company's general dividend, they would make it up by the payment of the necessary sum of money, and that if such sum of money was not paid by the proprietors for three consecutive years they should be liable to the company for a full third part of the cost for making the line. This was the bargain of the company with the public; and he asked his Honour if they had adhered to that bargain in constructing tramways, charging rates for which they had no statutory authority, and then bringing an action to enforce them. Mr. Finlay then proceeded to quote in support of his arguments the case of the "Stourbridge Canal Company *v.* Queeney," in which Lord Tenterden in his judgment said:—"The canal having been made under the provisions of the Act of Parliament, the rights of the plaintiffs are derived entirely from that Act; this, like other cases, is a bargain between a company of adventurers and the public, and the rule of construction in such cases is that any ambiguity in the terms of the contact must be construed in favour of the public, and not of the adventurers;" and "The Hull Dock Company's" case, as well as that of the "Leeds and Liverpool Canal Company," in which the same principle was laid down. He concluded, after a speech of two hours, by enforcing his main point of defence—that the Canal Company had no lawful authority to charge a tollage beyond a penny, and therefore would claim no more.

Mr. Webster having replied on the points of law raised,

His Honour said the points were of such vast importance that he would reserve his judgment.

Judgment reserved accordingly.

## MINING BY MACHINERY.

Hitherto it has not been considered essential in the construction of machinery to supersede manual labour in drilling holes required in the course of mining operations to imitate as nearly as possible the motion of the human hand in using the jumper or hammer, and some have expressed the opinion that it is through neglecting the imitation of hand labour that so little has been done with mining machinery generally. Whether this is actually the case has, however, yet to be determined; but as an elaborate invention, the leading feature of which appears to be the close imitation of hand-drilling, has recently been patented by Mr. INGLEBY MILLER, of Gracechurch-street, it may be hoped that the question will soon be settled. One or more hammers are fixed by axles to the edge of one or between the edges of a pair of revolving discs, the handle of each hammer will be extended towards the centre of each disc At some convenient place the handle will be either pierced for a pin or furnished with a cross-bar to connect it with the disc. Each hammer will thus play on an axle. There may be a hammer head at each end of the handle, or the end of each handle may be fastened to the end of another hammer mounted on the opposite side of the disc by a straight bar of metal, so that the hammers playing on their own axles will keep each other in motion, so that when the handle of the one hammer is at or near the outer edge of the disc, the other hammer will be at the extreme limit of its circumference, and thus when one hammer has delivered its blow, the other will follow and strike the succeeding blow. Other modifications may, of course, be introduced without affecting the invention.

The drill by which the effect of blows is conducted from the hammer to the substance to be acted upon will be so mounted that the head of it can be presented and held fast to receive blows from the hammer at any point of the disc. Where the drill has to work on a line horizontal with the movement of the carriage of the machine, it can be fixed in any way found most convenient—as by extending a cover over the drill in connection with some fixed part of the machine, and erecting thereunder the holdfasts or supports by which the drill can be secured in its place, or in any other convenient way. If the drill has to work in various directions, and in lines oblique to the line of motion of the said carriage, it can be fixed and made to act in such various directions by means of arms of metal, each arm being pierced with a round hole at some convenient part of its length, by which it can be affixed to the axle of the disc, one being fixed on each axle of the disc, and both so bent and extended forward and upward as to be in front of the disc and above the line in which the hammer revolves, and from thence continued along and over the line of the drill, the part so continued being united from end to end either by a covering or by bars of metal from which the holdfast sending in rings or circles, as next hereinafter mentioned, will be suspended and fixed for securing the drill with the head presented and fixed for receiving blows from the hammer at any point of the circumference of its revolution; these arms will also be extended behind the disc clear of machinery, and there united so that each pair must move in unison.

The drill is to be fixed in place by being driven through two or more rings or "circles" fixed in the cover or to the bars uniting the arms. Where the drill is required to strike a different surface at each blow it receives, then one of the rings (for he proposes to make the circles in two parts) will be extended on one end to admit of a toothed cog or spur wheel being affixed, to which any convenient gearing may be applied for turning the drill. He thinks the better plan would be to use a bevilled wheel, and attach from some convenient spot near the drill appliances to hold a like wheel, by which the turning may be effected through a leather band revolving from an axle of the disc, so that both hammers and drill will revolve or work in unison, and no damage will be done to the machinery should the drill get fixed in its work. Should the drill get fixed in its work it may be relieved by a spring that acts by pressure or contraction to help the recoil; this spring will be attached at some convenient spot near the drill, and a piece of metal of such form and of such shape and appliances that it will slide along the drill and be screwed on it at any spot, and be used either to press a spring acting by tension or by attaching a spring thereto, and so giving tension to one acting by contraction; this same piece of metal may be shaped so as to act as a pointer to a graduated metal or wooden scale affixed by the side of it to indicate the penetration of the drill.

The machine may be enlarged, and the power increased by means of multiplying and fly-wheels; the discs may be built one over the other or side by side, and made to work separately, or two or more may be made to work together by connecting them with suitable gearing. They may be so geared that where there are two side by side the hammers of the one will strike the drill at the top line of the revolution of the hammer, and the hammers of the other will strike a drill at the bottom line of the revolution of the hammer, both drills working in the same direction; or where one disc only is used the hammers may be so geared that by altering the gearing they may be made to strike the upper and lower drill, or each pair of hammers may be made to strike on the opposite direction; or the disc itself may be made to turn round on its carriage so that the same hammers can without altering the gearing strike two drills working in the same direction, the one being above the other. The arms for holding the drills may be made double so as to hold two drills, one on the upper and the other on the lower line of the revolving hammers. He claims the plan of the revolving disc, and the way of attaching the hammers thereto, so as to strike the drills in the several ways above specified; of fixing the drills in their circles, holding them fast to receive blows from the hammer, and admit of their being removed and replaced, also where required of turning them within their circles; for relieving them when jambed, and indicating the depth of their penetration when boring holes; also the plan of mounting them on supports or arms capable of revolving on the same axle as the disc, so that the drill can be presented to receive its blow at any point of the circumference; and the plan of putting the machine together when required so that the discs, hammers, drills, and attendant gearing may be fixed and made to move forward and backward in unison, and on one common line of motion, whether it be on a line horizontal with any movement of the carriage containing the machinery, or at any desired angle oblique thereto; and for fixing and steadying this machinery in its place when built and put together to be moved at divers inclinations. The contrivance of the machine has evidently been the subject of mature consideration on the part of the inventor, and every care seems to have been taken to meet the several objections that have hitherto been urged against machine drills. Whether Mr. Miller's arrangement will be efficient can only be determined after practical trial, the record of which cannot fail to be interesting.

## OBTAINING MOTIVE POWER.

An invention which promises to be of some importance, and has for its object improvements in obtaining motive-power from a fall of water, has been provisionally specified by Mr. JOAQUIM A. DE MACEDO, of Burton-house, Leeds. In order to effectually and economically utilise the weight or pressure of a fall of water of any height, he employs a heavy cylinder mounted on a horizontal axis, and having jointed to its periphery six or other number of flaps or paddles which can fold down on to the cylinder and completely enclose it. The flaps or paddles when so folded form a true cylindrical surface. Underneath the cylinder and concentric with it is a trough extending (say) one-third round the cylinder, and the ends of the trough fit closely to those of the cylinder. The water to actuate the machine comes in down a pipe or passage into one side of the trough, and issues at the other side of the trough. The flaps or paddles when on the under side of the cylinder fall down, turning about the joints connecting them with the cylinder until they stand radially, or nearly so, with their outer ends resting against the bottom of the trough; they then obstruct the flow of the water through the trough from side to side, and compel the water in escaping to turn the cylinder, and from the cylinder motion may be given to machinery by ordinary driving gear. On the descending side of the cylinder where the flaps or paddles enter the trough in order to make a water-tight, or nearly water-tight, joint with the end of the pipe or passage which supplies the water, so that the water may be compelled to pass through the trough and under the cylinder in order to escape; a hinged flap is provided, it is a portion of the side of the descending pipe adjacent to the cylinder; it is kept in contact with the cylinder by the pressure of the water and by a weight. The pressure of the flap against the cylinder may be adjusted by a screw so as to avoid unnecessary friction. The weight of the cylinder is such that the water pressure beneath it is sufficient or nearly so to raise it, so that the friction on its axes is small. The speed of the apparatus is self-regulating and requires no governor, the speed being always in proportion to the quantity of water supplied to it, any variation in the load will immediately cause a corresponding variation in the level of the water in the supply tube, which will be completely full when the wheel is doing its maximum duty. Where the quantity of water is very variable, and a constant speed required, this will be attained by gearing.

NEW SMELTING PROCESS.—A new process for smelting copper and other ores has been patented by Mr. W. POLE, in South Australia—it is intended for the purpose of economising the present cost in the erection of furnaces, and in labour and fuel. It is not confined to smelting copper ores only, but is also complete for the reduction of quartz, iron, silver-lead, and other substances. The usual outlay for constructing furnaces for the reduction of copper ores in any quantity and percentage is, under the present system, costly, inasmuch as four furnaces are required, and are not erected under a cost of 2000*l.*; while Pole's process consists only of a calciner and a cupola blast-furnace, with refining pan attached, the latter having a cross fire playing over it, by which method, at an outlay of the following:—Cost of one cupola furnace, blast-pan, piping, and 4-horse engine, 250*l.*; cost of two ditto, with 6-horse engine, 350*l.*; cost of four ditto, with 10-horse engine, 500*l.*—each furnace is capable of reducing 50 tons of carbonates or oxides in 168 hours. Another great feature is the economy in the working. The E. and A. Copper Company's returning charges for reducing to fine copper quantities of copper ore—say, from 1 to 30 tons—average about 70*s.* per ton of ore, and largo quantities of certain class ores are charged at about 55*s.* per ton. The Wallaroo Smelting Company charge about 50*s.* per ton, while Pole's process costs only from 30*s.* to 35*s.* per ton of 2½ cwts. The calcining will cost from 2*s.* 6*d.* to 3*s.* per ton extra. Further advantages are these:—That no crushing or jigging is required, nor water used for dressing the ores, and that furnaces under this patent can be erected by small capitalists, with or without the aid of a company, on any ground where ore is in fair quantity, and wood and water available. The fuel is charcoal and wood, which is well known to produce metal of better quality than ore smelted by common coal. Mr. Pole was at the Californian diggings in 1848, where he remained till those in Victoria were discovered. He went there, and during his stay introduced a blast-furnace for smelting quartz, but the public were too much engaged with the new crushing process, and would not entertain his principle. On coming to South Australia he still endeavoured to carry out his former idea, and bought an interest in the Palmer Mine, where he erected a patent apparatus, with success, only using, however, smiths' bellows for a blast. He then returned to town to get steam-power, and seeing Mr. Ive in November, 1869, that gentleman advised him to erect works in the city. Mr. Ellis, the founder, of Hindley-street, kindly volunteered to assist with steam-power, and the trial on Monday was the result. The plant consists of a cupola furnace 13 feet high, resting on foundations 2 ft. 6 in. in height; a fan giving 1800 revolutions per minute, and a 5-horse engine made by Messrs. Reynolds and Ellis. The blast from the fan runs underground through a wooden culvert to a piece of cast-iron piping, and the air gains admission to the cupola through tuyere holes. As regards the actual operation, the cupola, which is built principally of fire-bricks, is first of all heated to a white heat by means of a blast. It then flows into a second furnace of oblong shape, which adjoins, and the unity of the flames at the point of contact separates the metal from the slag, also refining the latter. The slag runs off at one end, and the copper from a tap-hole below. The apparatus is capable of smelting 33 tons 15 cwts. per week of seven days. Very little fuel is required, and the necessity of only having one process is a great advantage. The wood and charcoal for fuel are poured into the top of the cupola with the ore and flux, and the former is reduced to a liquid state at the smelting point about 3 feet above the tuyere holes. The ore used was from the Palmer Mine, estimated at a fraction over 9 per cent.

NEW GOLD SEPARATOR.—Mr. JOHN PHILLIPS, the surveyor, an old Ballarat mining authority, who has been lately appointed master of the Ballarat School of Mines, some years ago invented a machine for separating fine gold from tailings, sludge, &c. Various trials have been made, and Mr. Phillips says that the machine has answered very well, but has never yet been worked as he deems it best adapted to be used—directly in front of the stamp-boxes of a battery, so that the tailings might pass into it instead of going over the usual ripples, &c. On Friday we saw some experiments made by Mr. Phillips at Mr. Sleep's premises in Lydiard street, and the separator saved some wonderfully fine gold. It is not an easy matter to give a tolerably clear description of a machine without diagrams, but some attempt is necessary. The separator has a framework about 8 ft. long, 5 ft. high, and 2 ft. wide. At one end is a hopper-through which the feeding is carried on. The stuff falls through into a trough about 1 ft. wide, and (say) 6 ft. long. This is divided into six divisions, by having the bottom shaped in an undulating form, so that the water washes the sludge from one to the other, leaving the heavier particles in the first, and so on. The stuff while passing through is kept in motion and, so to speak, "fluidised" by a steady supply of water, and by the action of a large number of screws flattened at the head, that are attached to a framework that has an up and down motion. Screws are used because by simply having the head flattened a tooth is formed that is capitally adapted for keeping the earth from getting too solid. The whole thing was worked by a small wheel which a man can turn easily, and it is estimated that it had sufficient capacity to take the sludge from an 8 or 20 head battery. When in use it would be driven by an endless band worked by the engine, and would not require any manual labour. The combs or teeth act with a double effect, both in assisting the lighter matrix down with the water, and in assisting the heavier to resist the stream. This is effected by the trough and the framework bearing the teeth having different motions, the former being up and down, and the latter horizontal. Both can be varied by screws and belts easily arranged, and the trough can discharged in less than a minute by lowering the end, and allowing the water to sweep out the heaviest sand, containing gold, into a receptacle. The machine acts by specific gravity, and the inventor holds that it is so perfect that it will save precious stones from their soil, and tin, lead, and heavy black ores from the lighter green pyrites, the mercury and amalgam, from their greater weight, being presented clean for the filter. Uses to which the machine may be put are for cleaning up the contents of stamper-boxes the separation of iron (by magnets), and for amalgamating, performing in an hour what usually takes half a day or more. One property the separator has is to collect all small particles of quicksilver in the upper division of the trough, where they remain, and become, as it were, compact. Mr. Phillips claims the following advantages:—Small first cost, slight driving power, and very little wear and tear. Trials on Friday consisted of putting through several lots of powdered refuse containing small quantities of gold and silver, and very slight particles of quicksilver. Some had been passed twice through an amalgamating barrel, and in addition passed off three times; yet the separator brought to view a good deal of fine flour gold and some globules of quicksilver that had escaped all the other trials. The experiments made were highly satisfactory, and judging from them we would be inclined to pronounce the invention to be one that will become somewhat generally used. The whole affair is very light, and can be taken through any ordinary doorway into a crushing-house or engine-room. Mr. Phillips has in addition some plans for separating the rough waste of sludge from the floating slime, that always contains some very minute particles of gold, and then for separating the minerals and metal in the slime from the muddy mixture. A patent has not been secured for the process last referred to

MINING IN VICTORIA.—The period since the date of our last summary, exactly four weeks, has been one of larger than usual yields in alluvial grounds. This is notably the case in the Band and Albion Consols Mine, which this time heads the list with the splendid total of 2722 ozs., thus beating all the other companies, both quartz and alluvial, in the district. It is the more notable as the mine was considered almost exhausted, and tributers had to be invited to prospect, a process which has led to the discovery of some good ground, and to an increase in the value of shares. Consols shares are now quoted at 3*l.* 10*s.* that during the year were sold at 9*s.* The Hand and Band, Park, and the steady mines in the Smythesdale divisions, have well kept up their yields, and in both quartz and alluvial yields this summary shows an increase over the totals of last one, although from fewer companies. From 35 alluvial companies we have a total of 14,217 ozs., and from 34 quartz companies 7252 ozs., as against 13,071 ozs. from 40 alluvial companies, and 6307 ozs. from 33 quartz companies in our last summary, and this too without including the yield from the St. George and Band of Hope United, which has been heavy, but which has, for strategical reasons, been kept secret by the shrewd manager who watches over the company's affairs. That the yield has been heavy may be inferred from the fact that while fighting the Band and Albion Consols Company at law over a piece of disputed ground, a dispute just won by the St. George Company, three dividends of an aggregate of 6600*l.* have been declared within the month. At the coming of the Christmas and New Year holidays our mining companies do their best to declare dividends, and we have this month 22,062*l.* declared by eight companies—viz., St. George 6600*l.*, Park 6400*l.*, Consols 3367*l.*, Hand and Band 3200*l.*, Galatea 1050*l.*, Reform 500*l.*, Clunes 495*l.*, Queen Victoria 450*l.* Besides these dividends have been declared by co-operative companies and by some registered companies whose share list is not at hand, and whose dividends we therefore do not include in our estimate. Another little fillip to discovery has been made by the finding of a patch of shallow ground, rich in nuggets, at Kitty's Lead, near the Durham. Several hundred diggers are there, and the nuggets, varying from a few ounces to 7 or 8 lbs. in weight, have been found only a few inches below the grass. In quartz mining there seems to be a greater disposition to home work, and some new and remunerative yields from the White Horse and Canadian Ranges are drawing attention afresh to that large and promising quartz-field which is some day to be busy with a permanent industry.—*Ballarat Star, Dec.* 31.

## THE CANADIAN LUBRICATING OIL.

The abundance of mineral oil in Canada has long been well known, but owing to the nature of the impurities with which it is contaminated it has hitherto been altogether impracticable to turn it to marketable account. The removal of the disgusting odour complained of in the crude Canadian oil has hitherto so completely baffled the efforts of inventors that there has been a general disposition to consider it inseparable, or, at least, to regard the separation of the sulphur and arsenic as involving so difficult and costly a process of manipulation as to make it commercially unremunerative, especially as in all previous attempts to neutralise it by chemical means the odour has invariably returned, having been only temporarily neutralised or disguised. The existence of this offensive odour has reduced the price of the Canadian oil to one-fourth the price of United States crude oil, although otherwise the qualities are quite equal. Messrs. Houghton and Howell, of St. Catharines, Ontario, claim to have overcome all difficulties in this respect, and to have succeeded in producing an oil which no Canadian oil manufactured by the common process can compete with. The residuum to the extent of 40 per cent. of the crude oil, which is wasted by all other makers, is not only utilised by Messrs. Houghton and Howell, but the most valuable products are obtained therefrom by their processes. From this waste material a lubricating oil is produced which has no equal either in Europe or America—a fixed oil, that is not decomposed or dried up by the heat of engine cylinders, that is not injurious to iron, that will not oxidise, that produces no acid reaction, that remains perfectly limpid at 2° below zero, and that is not explosive or inflammable.

Next to the important object of deodorising the Canadian oils is the utilising of the crude oil to the greatest possible extent, and in this respect the success obtained is most satisfactory. They have obtained from 50 to 60 per cent. greater yield than any other manufacturer, and their oils have obtained the highest possible reputation amongst consumers. The surplus crude oil of the dominion now unsaleable is estimated at 350,000 barrels per annum, the whole of which can be controlled and manufactured by a company working the new process, and the estimated profit derivable from its treatment is no less than 420,000*l.* The future works of the Dominion of Canada Oils Refinery Company, which has been formed for developing the invention, are to be erected at Port Sarnia, situated upon the river connecting Lake Huron with Lake St. Clair, 14 miles from the oil wells, with railway carriage direct into the works, and having competing lines of railway, as well as navigable water for six months of the year; thus affording direct communication with all parts of the world. The estimated cost for the land, buildings, and additional machinery is 20,000*l.* The price fixed by the Government for 23 acres of land, with extensive river frontage, is less than 800*l.* The oils manufactured by the new process are considered to be in every respect superior to the American oils, and it is confidently anticipated that the company inaugurated for developing the process will prove a great success.

## THE GREAT CAROLINA MARL BED.

The phosphatic rocks of South Carolina are of such great extent, and afford such excellent facilities for the establishment of successful commercial undertakings, that such a detailed account of them as is given by Prof. HOLMES, of Charleston, in his pamphlet, just issued through Messrs. Trübner and Co., of Paternoster-row, will be of very general interest. With regard to the origin of these rocks, it is pointed out that though the Charleston phosphate-rock basins were formed in the post-pleiocene age the rocks deposited in them do not actually belong to that age, but in fact to the eocene, an older formation. It has been ascertained beyond doubt that frequently rocks or fragments of rocks of older formations, and, therefore, of greater age, are found in newer deposits of a comparatively recent date. Quartz pebbles and fragments of water-worn crystalline rocks are often seen embedded in modern clays and sands. The phosphate rocks of these basins, like the quartz basins just named, have been derived from an older formation—the eocene marl, or the great Carolinian bed of marl which is the foundation of the whole sea-board country of South Carolina, and is composed of the Santee, Cooper, and Ashley River marls, which in the aggregate are 700 ft. thick.

The similarity of the phosphate beds, near Cambridge, in this country, is referred to as very similar to those of Charleston, and he remarks that the nodular fragments of eocene rocks are composed (like the mother rock from which they had been broken off) entirely of the dead shells of marine animals, which age after age were deposited at the bottom of the ocean, or eocene sea, and finally became an immense bed or formation of marl, enclosing throughout its great depth not only the polythalamous shell, corals, and coralines, but the teeth and bones of sharks and other fish and of whale-like and alligator-like animals, such alone as live in the sea, but no remains of any land animal have ever yet been found in it. He states, without any fear of contradiction, and challenges proof of a single specimen being obtained from or embedded in the nodules (phosphate rocks), or from the marl bed itself, the mother rock. All the remains of land animals obtained in such vast numbers are mingled with, and not imbedded in the nodules found in the phosphate basins, and this mingling of bones and teeth occurred in the post-pleiocene age after the elevation of the basins above the ocean level. It was in this post-pleiocene age that the rocks prepared of old at the bottom of the ocean were converted into the basis of a most wonderful fertilising substance, a substance which was to become by the labour and sweat of man's brow a renovator of his worn out soil, causing it to yield in overflowing measures bread and meat for the use of the sons and daughters of men, and not for their use only, but to give food in great abundance to the animals who are man's companions in the present age; to the ant, the bee, and the butterfly, animated links in the chain of creation, by which the whole fabric itself is sustained.

After explaining how the nodules were converted into phosphate rocks, Prof. Holmes proceeds to state what has been done towards the development of the South Carolina phosphate beds, and furnishes a list of the organised companies

engaged in mining and in manufacturing the material into fertilisers. The Charleston, So. Ca., mining and manufacturing company, was the pioneer in developing this great and most valuable discovery, and was organised in 1867. Many difficulties had to be surmounted; it was a new and untried field; thousands of dollars were expended before the proper mode of working the diggings could be known. Labourers were scarce, and the negro, unaccustomed to such work, accomplished very little towards a day's task. The best time for mining was during the summer, or dry season of the year, when the white labourer could not withstand the chills and fevers of the season; in a word, difficulties and oppositions arose every day, and in every form. Where the company expected to keep employed 1000 labourers, 30 could not be placed. The thing could not be done in a day; time was required to develope and work out the problem. Time was required for the manufacturers of fertilisers to test the new material. But now they have done so at the north, east, south, and west; in England, Scotland, Ireland, France, Germany, and Spain the demand for the raw material has increased twenty-fold. The company has expended large sums in purchasing lands, and these lands are now valued at millions. Within the past year 30,000*l.* has been paid for buildings, wharves, mills, machinery, railroads, and locomotives, besides giving two dividends to the shareholders. The capital is 160,000*l.*, with power to increase to 200,000*l.* The result of an analysis by Mr. G. A. Liebig of an average sample of South Carolina phosphates showed—moisture (determined at 10·0 c.) 6·225, phosphoric acid, 28·874 per cent., which is equal to 63·034 bone phosphate of lime. And rendered perfectly kiln dry it will contain of calcined bone phosphate of lime 67·219 per cent. Phosphate lands in the neighbourhood of Charleston, which before the discovery were held at $2 per acre, immediately advanced to $20, and have been going up steadily ever since. One plantation, belonging to a widow, valued formerly at $6000, was bought by the Charleston Mining and Manufacturing Company for $45,000, and is now valued at $500,000. Sales have been lately made to other parties at $1000 per acre. The company owns about 10,000 acres of the best quality phosphate rock lands, carefully selected by competent persons; it has a mining lease also of 12,000 acres, for which they are to pay a royalty of one-tenth of the rock mined.

The Wando Company was the first to manufacture the material into a fertiliser on the spot, and their fertiliser has given a high reputation to the deposits, and caused in a great degree the present excitement in phosphatic enterprises. The Etiwan Sulphuric Acid and Superphosphate Company is founded on the principle that it will prepare and furnish guanos of the highest possible grade of fertilisers. The Oak Point Mines, which are very favourably situated, are in private hands. The Marine and River Phosphate Mining and Manufacturing Company of South Carolina has the sole right to excavate those phosphatic deposits which underlie the navigable waters of the State. With the facilities at the command of the company, it can furnish 2000 tons of rock per week, whilst its great resources and appliances enable it to offer high grade phosphates at the lowest rates. The Carolina Fertiliser (selling largely), Chicora Mines, Atlantic Phosphate, Stono Phosphate, Farmers' Fertiliser of South Carolina, Palmetto Mining and Manufacturing, and Pacific Guano Companies, will all shortly be sending large quantities into the market, but are at present only in course of development.

## FOREIGN MINING AND METALLURGY.

The deliveries of coal from Belgium to France have acquired more animation, and also more regularity. The railway service still leaves, however, a good deal to be desired, and affairs cannot be expected to fully regain their normal course until the German troops have evacuated the French territory. The evacuation appears to be proceeding with great rapidity, except as regards the territory which the Germans propose to occupy for some time. The annexation to Germany of the metallurgical groups of the Meuse and the Moselle will probably exert some influence on the Belgian coal trade; it seems certain that a large increase will take place in the exportation of German coal and coke to the annexed districts, which were formerly principally supplied from the Belgian collieries. Another source of uneasiness to Belgian coalowners has been the attribution to M. Thiers of an intention to establish protective duties on commodities imported into France, so as to increase the revenue at the disposal of the French Treasury. At present Belgium exports annually to France upwards of 3,000,000 tons of coal, and a considerable quantity of coke. If duties higher than those which now exist should be imposed on Belgian products a notable diminution might be anticipated in the exports of Belgian coal to France, while the French collieries would simultaneously increase their production. For the present, however, the price of coal is well sustained in Belgium, and the extraction is pushed forward with great activity. Freights to Paris are 10s. 6d. per ton. The united collieries of the valley of Piéton, at Roux, have been provisionally disposed of for 8000*l.* The definitive adjudication has been fixed for May 8. The Kessales Colliery, at Jemeppe, commenced the payment on Monday of its second dividend for 1870, or 1*l.* 8s. 8d. per share. The Sacré-Madame Colliery Company, at Dampemy, will pay a dividend for the past year on May 1.

Attention is a good deal devoted to the annexation to the Zollverein of the Moselle group, and the Mulhouse engine and machine workshops. The forges and rolling-mills of the Moselle seem likely to carry on an active competition with the German groups; before the war the same qualities of iron produced upon the same conditions were quoted about 33 per cent. dearer on the German side of the frontier than at Hayauge, or Moyeuvre, or Styring-Wendel. The question is discussed whether the transfer to German dominions of the French forges will cause prices to fall in Germany, or whether French industrials will adopt the higher German tariff.

Two blast-furnaces are about to be lighted in the Charleroi group. One of these furnaces, if we are rightly informed, belongs to the South of Charleroi Blast-Furnaces Company, the other belongs to the firm of Cornil and Co., of whose works M. Charles Duprez is the managing director. The new furnaces are of large dimensions, and will be enabled to produce from 30 to 40 tons per day. The state of the Belgian iron trade continues to improve. The works receive a good current of orders, and are supplied with employment for some time in advance, especially as regards iron, rails, and plates. The state of the pig-iron market is very good, and an advance in prices is anticipated. A Bill has been introduced into the Belgian Chambers, opening to the Belgian Department of Public Works a special credit of 260,000*l.*, for the purchase of plant, and also for works to be executed at stations. There are continual rumours as to a system of protective tariffs being in contemplation in France. The French tariffs were already sufficiently high to render useless all attempts at competition on the part of Belgian works against French works, not only with the Moselle group, which has now become German, but also with other establishments.

The metallurgical investments of the General Company for Promoting the National Industry of Belgium yielded last year an average return of 6·68 per cent. The undertaking of the Produits Colliery Company has been maintained at about the same level as in former years; various improvements have been introduced into its works and equipments. The exploratory works undertaken some years since in the northern part of the company's concession have been continued, and the nature of the ground met with induces hopes that it will be possible to turn it to more advantageous account. The Produits Company has further just acquired the Nimy concession, 3056 acres in extent. This purchase will enable it to extend still further its means of production, when the necessity for doing so is recognised. The West of Mons United Collieries Company has suffered greatly from the events which have occurred during the last seven months in France.

The continental copper markets display a firm tone, transactions showing a certain animation. At Havre, Chilian in bars has made 66*l.* to 67*l.*; Peruvian minerals, pure standard, 70*l.* to 70*l.* 10*s.*; United States (Baltimore), 76*l.* to 78*l.*; ditto Lake Superior, 80*l.* to 86*l.*; Mexican and Plata in bars, 66*l.* to 68*l.*; old yellow copper, 40*l.* to 44*l.*; red ditto, 62*l.* to 66*l.* per ton. At Marseilles, Toka for consumption has been quoted at 80*l.*; refined Chilian and Peruvian, 80*l.*; rolled red copper in sheets, 84*l.* per ton. At Rotterdam, Drontheim has made 50 to 52 fls. Tin has been quiet in Holland, and has been rather offered than otherwise. Disposeable Banca is quoted at 77 fls.; ditto for future delivery 75 fls. Billiton on passage has been quoted at 76 fls.; disposeable makes default. At Marseilles lead in saumons, first fusion, has made 18*l.* 8*s.*; ditto, second fusion, 18*l.* to 18*l.* 4*s.*; ditto argentiferous, 18*l.*; ditto in shot, 20*l.* 16*s.*; rolled and in pipes, 20*l.* 16*s.* At Rotterdam, Stolberg has realised 11 fls.; and miscellaneous marks, 10¾ fls. Zinc has been well supported. At Marseilles rolled zinc is quoted at 30*l.* per ton, but this rate will, probably, now tend downwards at the great Mediterranean centre.

HOW HYDRAULIC MINING IS CARRIED ON.—The Nevada *National* gives the following description of a new and extensive hydraulic mining enterprise in Nevada county:—"Rolfe, Stranahan, and Co. have nearly completed their preparations for hydraulic mining at Cement Hill, about 3 miles west of Nevada city. They have one of the most substantially built flumes we have seen in any hydraulic mine in the county. It is 750 feet in length, 4 feet wide, and 2 feet deep, with a grade of 8 in. in every 12 feet. In the flume they have three under currents, each with a drop of from 15 to 25 feet. These drops are so arranged that all the stoney and bulky pieces of cement or other matter will pass over upon slats or bars laid across the end of the flume and be precipitated down the falls, while the gold and finer particles of sand will drop into the under-current and pass over a neatly-jointed flume, about 6 ft. wide and 30 ft. long. These under-currents have been found to be excellent gold-savers; the drop, also, is of great benefit where there is cement to contend with, as in making the plunge over upon the rocks the cement is more or less broken up and pulverised. Messrs. Rolfe and Co. have all their pipe upon the ground, and will soon be in complete readiness for work. They have 18-inch pipe connecting with their bulk-head, and extending down 500 ft., where it will connect with 11-inch pipe. They will have 175 ft. perpendicular pressure, and will use 500 inches of water. To procure the latter they have in the last three weeks opened over threee miles of ditch, which extends from Cement Hill to the Sugar Loaf, above the city. The Company will commence dydraulicking on a large slide of about two acres, that was caused by a portion of the ground being drifted out many years ago. Only about one-fouth of this slide was drifted out, and it paid well. The depth of this slide will not average more than 60 ft. The company expect, with the amount of water and pressure at their command, to strip off this slide down to the bed-rock in a thirty days' run. They have fitted up their claim in the most substantial manner, and in accordance with the most approved methods for working deep gravels mines. If this company does not succeed in its enterprise, it will not be for the lack of foresight in making good preparations.

## FOREIGN MINES.

DON PEDRO NORTH DEL REY (Gold).—Telegram from Lisbon Produce for January, 7384 oltas.; weighed to February 18, 2655 oltavas.

TAQUARIL (Gold).—The following telegram has this day been received from Lisbon:—"Remittance, 4518 oits. Produce not looking well."

JAVALI (Nicaragua).—The managing directors' report for January shows that the rainy season still continuing, he is able to remit 322½ ozs. of gold, valued at 724*l.*, against an expenditure of 550*l.*, thus leaving again a clear profit on the month's working. A cross-cut into the upper portion of the mine had been completed, enabling the manager to obtain ore at the low rate of 1*s.* per ton. In the newly opened up portions of the mine the lode was found to be from 18 to 20 ft. wide, of treatable nature and good quality.

CHONTALES (Gold and Silver).—The directors have advices from Mr. Belt dated Feb. 6:—Return of gold for the month of January, 365 ozs., from 1101 tons of ore; average yield, 6 3-5 dwts. per ton. Cost for the month, $1408, showing a profit on the month's working of 130*l.* Mr. Belt reports—"The connection level at San Antonio Mine has at last been driven into good ground; the end is now worth 10 dwts. per ton."

BATTLE MOUNTAIN (Nevada) —J. Richards, Feb. 16: As noticed: in my report of last week, we have resumed sinking Hallow's shaft, and in about a month from this date, if the ground continues favourable, we shall be deep enough for a 40 feet drivage below the 73, or in other words a 113 feet level; the ground in the shaft during the last week has been a very dark, softish, greasy looking killas, not at all favourable for deposits of mineral in my opinion, but as this has come in under the gossany ledge matter which we had, and as now there seems indications of another change of ground, I shall watch it anxiously, hoping it may have a tendency for benefit before long. We were getting occasionally splendid stones of copper ore, but have seen none the last week. As soon as the shaft reaches the 113 feet we shall immediately drive and communicate with Roach's winze, and be enabled then to take the ore ground between the two points, not only to greater advantage and less expense per ton, but it will add to the ventilation and general improved air in the mine. The stope in the bottom of the 73 feet level, at Roach's winze, is producing some rich ore, although not in such quantities as before; the cross-cut noticed last week as having been driven here proves the lode to be very wide and orey; most of the ground will do to come away when the 113 drivage from the shaft shall have been brought in. The lode in Moore's winze continues to produce fine specimens of rich ore, although not in so large quantity as we could wish, but it will leave good stoping ground when we shall have reached the 113, and communicated it with Roach's winze, as also get further increased ventilation, and this it is necessary to get, as in the summer months here, unless thorough and efficient ventilation has been secured, the men cannot do a fair day's work.—Lake Superior: Pryce's shaft has been set to sink below the 70 feet level, at $7 per foot; the lode here is orey all along as we sink, and I expect it will pay well for sinking, and open out ground that will leave a good profit in stoping. The ore from the winze sunk a few feet in the bottom of the 70 feet south level as noticed last week, proved a larger quantity and of higher quality than I had supposed from seeing it underground. When we can so arrange this winze (called Symon's) shall be continued for the purpose of opening up stopes, and for ventilation. I believe this will prove to be yet the richest and best mine of the two. We have 19 hands employed, having taken on one to sort over the dumps, in which I find some ore equal to any we have underground. We have sent 167 sacks of ore from Lake Superior since last report, and have a large heap from the shaft awaiting assortment. Ores sacked in the week 52½.

EXCHEQUER (Gold and Silver).—Feb. 13: During the week ending the 11th inst. 6 ft. were made in the upper tunnel and 6 ft. in the winze. I am pushing things to commence stoping as hard as I can.

PESTARENA.—Thomas Roberts, T. Warne, Jas. Roberts, March 9: Peschiera Mine: The lode in the north incline shaft, sinking below the 80 fm. level, yields 8 tons of ore per fathom, worth 1 oz. 5 dwts. of gold per ton. The end driving north in the 33 fm. level, on No. 2 lode, has greatly improved, now worth 6 tons of ore per fathom, at 1 oz. of gold per ton. We have suspended the rise in the 33, on No. 5 lode, and resumed driving the end north; the lode yields 3 tons per fathom, worth 14 dwts. per ton.—Boundary: In the 20 end, driving north, the lode is poor.—Acquavite Mine: In the 23 end, driving south, we have discovered a branch of ore, accompanied by a good channel of ground, in the west side of the end, and is approaching the lode; we hope shortly to be able to report an important discovery in this end. The 23 end, driving north, yields 4 tons per fathom, worth 10 dwts. per ton. The end driving north, in the end of ground below this level, yields 6 tons per fathom, worth 1 oz. per ton. The 33 end south yields 5 tons per fathom, at 12 dwts. per ton. The 46 end south yields 3 tons per fathom, at 1 oz. per ton. The 55 end south yields 4 tons, worth 1 oz. per ton. The 55 end north yields 8 tons per fathom, worth 10 dwts. per ton. The stopes yield on an average their usual quantity and quality ore.—Surface; The first lot of timber, which has been brought over the snow during the winter, is at the mine, and it is a good assortment for general use. We are now cutting down more trees, for a second lot of extra length timber, intended for the opening of the Beck shaft, and which will be brought on as speedily as possible; the progress in the Beck shaft has been slow, owing to the unfavourable weather in the past week. The water in the Anza is somewhat increased for our pumping, winding, and amalgamating machinery, and we have 139 of the small mills working at present.

P.S.—Val Toppa Mine: In the No. 5 level, driving south, we have an improvement, lode yielding 3 tons per fathom, worth 1 oz. of gold per ton. All other points are much the same as when last reported on. Good progress is being made in the cartage of ore from the mine to this establishment.—T. ROBERTS.

VAL ANTIGORIA (Gold).—T. Roberts, March 2: To get the south mine into its present position for hoisting from the 30 has long been looked forward to. The incline shaft on No. 2 lode has been sunk 10 metres under the 30 for a sump, have laid tramroad in the same, so that the water is now taken by the wagon drawn by the machine to the adit, and we have resumed driving of the 30 fm. level end south; the lode at present yields 2 tons of ore per fathom. We expect an improvement as this end advance southward into the run of ore ground. In the past month we have driven the 20 fm. level end south 5½ metres, and are pleased to say that the ground has changed, and the lode has improved in the last week, yielding at present 1½ ton of ore per fathom. The stopes in back of the 20, on No. 2 lode, south of winze, have not yielded much ore in the past month, at present looking better, yielding 1 ton per fathom. The stopes in the back of the 10 yields fully 2 tons per fathom. With our present prospects on No. 2 lode we expect our gold returns for the present month will exceed the last. The stopes on No. 1 lode, in the back of the 10 north, yield 1¼ ton per fathom. The stopes in the back of the 20 south, on this lode, yield 1 ton per fathom. We consigned this morning to Signor Carlo Menozzi one ingot of gold, weighing 786 grammes, equal to 25 ozs. 5 dwts. 9 grs., obtained in February from 36 tons of ore. In the past month one of the cast centers of the mill broke, and delayed the working of this mill for five days; it has since been repaired, and is working well.

LUSITANIAN.—Report for March: At Taylor's engine-shaft the lode is worth 2 tons per fathom. At the 140, east of Taylor's, the lode is 6 ft. wide, composed of quartz with ore, worth 1 ton per fathom. At the 140 west the lode is 5 ft. wide, composed of quartz and a branch of ore on the south wall, worth ½ ton per fathom. At the 130 east the lode is 6 ft. wide, composed of quartz, but speedy. At the 130 west the lode is worth ¾ ton per fathom. At the 120 east the lode is from 5 to 6 ft. wide, composed of loose quartz and stones of ore. At the 110, east of River shaft, the lode is worth 1½ ton per fathom. At the 70 east the lode is 4 ft. wide, worth 1½ ton per fathom. At the adit, west of Peres', the lode is 8 in. wide, yielding good but small stones of ore. At the 38, east of Taylor's, the lode is 1 ft. wide, worth ¾ ton per fathom. At the 38, west of slide lode, the lode continues to be in small branches, and letting out water. At winze No. 83, below the 70, the lode is 8 in. wide, composed of schisto. Winze No. 85, below the 130, west of Taylor's, the lode is worth 1 ton of ore per fathom. In winze No. 86 the lode is worth 1 ton.—Carvalhal: At the 60 cross-cut the ground is a hard gneiss rock. At the 60, east of incline, the lode is 1 ft. wide, composed of quartz and stones of blende. At the 50 east the lode is 2½ ft. wide, worth 2 tons of blende per fathom. At the 50 west the lode is 2 ft. wide, composed of soft quartz and stones of blende. At the 40 east the lode is 1 ft. wide, composed of quartz and country. At the 30 east the lode is in two branches, worth ½ ton per fathom. At the 20 the lode is composed of quartz and country. At the adit level, on caunter lode, the lode is 1½ ft. wide, worth 1½ ton per fathom for lead and blende. At the 10 west the lode is worth ¾ ton per fathom for blende. At the 20 west the lode is 2 ft. wide, worth ¾ ton per fathom. At the 30 west the lode is 3 ft. wide, worth ½ ton per fathom for lead and blende. At the 30 north, west of incline shaft, the lode is 1¼ ft. wide, composed of quartz and lead, worth ½ ton per fathom. At the deep adit level, west of Caima River, the lode is 2 ft. wide, composed of quartz and mundic, spotted with lead and copper.

PONTGIBAUD.—W. H. Rickard, March 2: Roure: The 80 metre level, south of Richards's shaft, yields a little coarse-quality saving work. The cross-cut at this level, towards Virginie's lode, is in stiff, spare ground. The rise under Agnes' shaft goes on regularly. The rise in back of the 60 yields a little saving work. The 60 east has intersected the first branch of Virginie's lode, which lets out a quantity of water, and yields some good stones of ore. We calculate to have about 8 metres more to drive to cut the main part. The 20 metre level north, on Virginie's lode, yields a little saving work. The rise behind this end yields 1 ton of ore per fathom; the 20 south yields ½ ton; adit north, 1½ ton; adit south, ¼ ton per fathom. Stollen south of Paul's shaft continues in poor ground. The intermediate level, north and south of Paul's old shaft, opens ground worth ½ ton of ore per fathom. The adit cross-cut, east from the mill, is in hard ground. The tribute pitches have improved in yield, on the whole, owing to the better quality of Virginie's lode.—La Grange: The 100 metre level, north of Nosky's shaft, yields ¾ ton of ore per fathom. The winze below the 80, over this end, yields ½ ton per fathom. The tribute pitches yield a little less than last month.—Micche: The lode has been intersected in the 20 metre level from the winze; it is 1 ft. wide, of orey stuff, worth ¼ ton per fathom. The two pitches in back of the shallow level yield fairly. At Bouzarat, having got sufficiently under the hill, we have set a cross-cut further westward in hopes of finding somethiug better than hitherto met with.—La Brousse: The 120 metre level south opens pretty good ore ground, worth 1 ton per fathom; the 100 south yields ¾ ton; the 80 yields 1 ton per fathom. The tribute pitches continue to produce well.—Pranal: The 70 north yields ½ ton of ore per fathom; the same level, on the western part of the lode, yields ¾ ton. The 70 south yields stones of lead ore and blende, but not in saving quantities. The 50 north is poor; the same south yields 1 ton per fathom. Winzes Nos. 1, 2, and 3 yield 1 ton per fathom.—Surface: The weather has been very favourable for dressing operations during the month; samplings, 277 tons.—St. Amant Roche Savine: The sinking of Susan's shaft is slow, the rock continuing hard, with an increase of water from the thaw. We are now down 24 metres below adit, and intend sinking to a depth of 28 metres, in order to commence a 25 metre level with a 3 metre fork. A trial at this level could be prosecuted under the valley without fear of letting down water. The adit cross-cut east having intersected nothing of value, we have resumed the driving of the adit north. The surface trial has been resumed; the lode in the shaft is 2½ ft. wide, of a kindly appearance, but yet without ore. We hope to be able to resume operations at Labrugère in about a week.

[For remainder of Foreign Mines see to-day's Journal.]

MINING ON THE PACIFIC COAST.—The following are the amounts paid to stockholders by various local mining incorporations during the year ending Dec. 31, 1870:—

| | |
|---|---|
| Black Diamond Coal Company | $300,000 |
| Union Pacific Salt Company | 26,265 |
| Amador (California) Mining Company | 155,400 |
| Argenta Mining Company | 21,000 |
| Chollar-Potosi (Nevada) Mining Company | 628,000 |
| Eureka (California) Mining Company | 430,000 |
| Golden Chariot (Idaho) Mining Company | 75,000 |
| Golden Rule (California) Mining Company | 3,000 |
| Gould and Curry (Nevada) Mining Company | 48,000 |
| Hale and Norcross (Nevada) Mining Company | 504,000 |
| Ida Elmore (Idaho) Mining Company | 20,000 |
| Kentuck (Nevada) Mining Company | 30,000 |
| Meadow Valley (Nevada) Mining Company | 150,000 |
| Metropolitan Mill Mining Company | 10,000 |
| North Star (California) Mining Company | 16,800 |
| Original Hidden Treasure Mining Company | 32,500 |
| Sierra Nevada (Nevada) Mining Company | 37,500 |
| Union (California) Mining Company | 30,000 |
| Wheeler Mining Company | 6,000 |
| Total | $2,552,650 |

The dividends of San Francisco mining companies for 1869 are reported at $2,133,400. This apparently does not include coal and salt companies. The increase of the dividends of gold and silver accordingly amounted to $93,000.

MINING IN ARIZONA.—Work has been resumed on the Constancia lode, a gold mine 12 miles east of La Paz, on the Colorado River. This vein is 5 feet wide, and very regular. There is but one shaft on it, of 75 feet in depth. The quartz is an excellent gold-bearing rock, with much free gold in it, and contains but few sulphurets. A new 20-stamp mill, now on its way from San Francisco, is expected to be in working operation in 60 days. The Constancia, although acknowledged a fine vein by everyone, has remained unworked for five years for want of capital. In the same district a tunnel is being run to cut the Conquest lode, another gold-bearing vein of great value.

DISTILLATION OF PETROLEUM.—By the invention of Messrs. J. L. HEVERIN and J. L. BEWLEY, Freedom, U.S.A., the petroleum to be operated upon is to be introduced first into an upper still or chamber, in which it is caused to trickle over the surface of a cylindrical casing, heated in a manner hereinafter described to such a temperature as to volatilise the most volatile parts of the petroleum. This vapour passes at once to a condenser, and being condensed forms a liquid known commercially as naphtha or benzine. So much of the petroleum as is not volatilised in the first still or chamber passes to a second, where it is brought in contact with steam; it may be exposed to a jet of steam, so as to disperse it as a spary through the still or chamber, or whilst it is running through the second still or chamber jets of steam may be projected on to or through it. The steam again volatilises a portion of the petroleum. The mixed steam and vapour passes into the casing within the first still or chamber, which is thus heated. A partition is provided within the casing to compel the steam and vapour to traverse from end to end of the casing before passing to the exit pipe, which leads it to the condenser, where the condensation of the whole of the steam and vapour from the second still or chamber is completed. The vapour yields kerosine oil. The remainder of the petroleum which is not evaporated in the second still or chamber is drawn off from the lower part thereof and is fit for use as a lubricating oil for dessing leather, for oiling wool, the manufacture of paint, and for other purposes.

LONDON GENERAL OMNIBUS COMPANY.—The traffic receipts for the week ending March 12 were 9326*l.* 16*s.* 3*d.*

## COPPER ORES.

Sampled February 15, and sold at Swansea, March 7.

| Mines. | Tons. | Produce. | Price. | Mines. | Tons. | Produce. | Price. |
|---|---|---|---|---|---|---|---|
| Cape Ore | 49 | 27⅞ | £18 10 6 | Cape Ore | 49 | 28¼ | £19 1 0 |
| ditto | 49 | 27⅞ | 18 1 6 | ditto | 49 | 28½ | 18 12 6 |
| ditto | 48 | 27⅞ | 18 11 0 | ditto | 2 | 28⅜ | 18 14 6 |
| ditto | 48 | 27⅞ | 18 7 0 | Moonta Ore | 85 | 13¾ | 8 15 0 |
| ditto | 48 | 27⅞ | 18 3 0 | ditto | 84 | 13⅜ | 8 15 0 |
| ditto | 48 | 27⅞ | 18 5 0 | ditto | 83 | 13⅜ | 8 15 0 |
| ditto | 76 | 29¾ | 19 13 0 | ditto | 77 | 13⅜ | 8 15 0 |
| ditto | 65 | 30½ | 20 2 6 | ditto | 125 | 13½ | 8 16 6 |
| ditto | 26 | 51 | 33 10 0 | Copper Ore | 36 | 14½ | 9 6 6 |
| ditto | 23 | 53⅞ | 36 1 0 | ditto | 4 | 26⅜ | 17 5 0 |
| ditto | 22 | 42⅞ | 28 7 0 | ditto | 2 | 17¾ | 11 2 6 |
| ditto | 20 | 42¼ | 27 15 0 | ditto | 24 | 12½ | 7 13 6 |
| ditto | 19 | 53⅜ | 35 5 0 | Berehaven | 26 | 8⅞ | 5 7 6 |
| ditto | 15 | 41¼ | 27 5 0 | ditto | 73 | 9¼ | 5 18 0 |
| ditto | 50 | 29¾ | 19 12 0 | ditto | 72 | 9 | 5 16 6 |
| ditto | 50 | 29¾ | 19 11 0 | ditto | 75 | 8¾ | 5 12 6 |
| ditto | 50 | 29⅝ | 19 10 6 | Brass Ashes | 86 | 6¾ | 3 8 0 |
| ditto | 50 | 29⅛ | 19 11 0 | Precipitate | 7 | 64½ | 42 3 0 |
| ditto | 50 | 29⅛ | 19 9 6 | Copper Ore | 17 | 20⅜ | 13 4 0 |
| ditto | 50 | 29⅛ | 19 9 6 | British Reg. | 11 | 44½ | 28 8 0 |

TOTAL PRODUCE.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cape Ore | 956 | £19,812 | 19 0 | Brass Ashes | 86 | £ | 292 8 0 |
| Moonta Ore | 454 | 3,981 | 17 6 | Precipitate | 7 | | 295 1 0 |
| Copper Ore | 66 | 611 | 3 0 | Copper Ore | 17 | | 224 8 0 |
| Berehaven | 246 | 1,411 | 14 6 | British Regulus | 11 | | 312 8 0 |

COMPANIES BY WHOM THE ORES WERE PURCHASED.

| Names. | Tons. | Amount. |
|---|---|---|
| Copper Miners' Company | 287 | £2511 5 0 |
| P. Grenfell and Sons | 183 | 3613 14 0 |
| Sims, Willyams, and Co. | 184 | 3750 7 0 |
| Vivian and Sons | 180 | 3635 3 6 |
| Williams, Foster, and Co. | 649 | 6801 13 6 |
| Charles Lambert | 163 | 3153 16 6 |
| Sweetland, Tuttle, and Co. | 197 | 3475 14 6 |
| Total | 1843 | £26,941 14 0 |

NO SALE on March 28.

TOTALS AND AVERAGES.

| | 21 cwts. | Produce. | Price. | Per unit. | Standard. |
|---|---|---|---|---|---|
| Whole sale | 1843 | 22¼ | £14 12 4 | 13s. 1d. | £ 86 14 6 |

## COPPER ORES.

Sampled February 22, and sold at Tabb's Hotel, Redruth, March 9.

| Mines. | Tons. | Price. | Mines. | Tons. | Price. |
|---|---|---|---|---|---|
| West Seton | 68 | £2 8 0 | South Frances | 25 | £4 1 6 |
| ditto | 67 | 2 7 6 | ditto | 19 | 3 17 6 |
| ditto | 62 | 4 17 0 | ditto | 17 | 3 7 6 |
| ditto | 58 | 8 0 0 | ditto | 3 | 17 0 0 |
| ditto | 52 | 6 17 0 | Poldice | 46 | 2 3 0 |
| ditto | 44 | 7 0 6 | ditto | 26 | 5 9 6 |
| East Pool | 97 | 2 14 6 | West Damsel | 36 | 3 0 0 |
| ditto | 82 | 2 17 6 | ditto | 34 | 3 6 6 |
| ditto | 69 | 3 11 6 | Mellanear | 27 | 2 1 0 |
| ditto | 48 | 3 10 0 | ditto | 26 | 9 1 |
| West Basset | 66 | 6 9 0 | Wheal Buller | 13 | 3 6 |
| ditto | 30 | 4 18 0 | ditto | 9 | 23 5 |
| ditto | 29 | 6 1 6 | North Pool | 13 | 4 7 6 |
| ditto | 29 | 3 5 0 | Pendarves United | 6 | 3 0 0 |
| South Crofty | 99 | 2 8 6 | North Roskear | 5 | 5 9 0 |
| ditto | 32 | 2 1 0 | Jewell's Ore | 3 | 4 0 0 |
| South Frances | 26 | 5 10 6 | | | |

TOTAL PRODUCE.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| West Seton | 351 | £1752 | 6 6 | Mellanear | 53 | £ | 290 13 0 |
| East Pool | 296 | 914 | 15 0 | Wheal Buller | 22 | | 252 9 6 |
| West Basset | 153 | 839 | 17 6 | North Pool | 13 | | 66 17 6 |
| South Crofty | 131 | 395 | 13 6 | Pendarves United | 6 | | 18 0 0 |
| South Frances | 90 | 427 | 10 6 | North Roskear | 5 | | 27 5 0 |
| Poldice | 72 | 241 | 5 0 | Jewell's Ore | 3 | | 12 0 0 |
| West Damsel | 70 | 221 | 1 0 | | | | |

Average standard..... £100 6 0 | Average produce..... 7
Average price per ton ..... £4 5 0
Quantity of ore .....1265 tons | Quantity of fine copper..88 tons 2 cwts.
Amount of money ..... £5359 14 0

LAST SALE.—Average standard..... £102 7 0—Average produce..... 6¾
Standard of corresponding sale last month, £102 2 0—Produce, 6⅝.

COMPANIES BY WHOM THE ORES WERE PURCHASED.

| Names. | Tons. | Amount. |
|---|---|---|
| Vivian and Sons | 244 | £1253 14 0 |
| Grenfell and Sons | 170 | 1370 8 0 |
| Williams, Foster, and Co. | 296 | 914 15 0 |
| Mason and Elkington | 149½ | 636 13 3 |
| Copper Miners' Company | 126½ | 483 15 9 |
| Sweetland, Tuttle, and Co. | 279 | 700 8 0 |
| Total | 1265 | £5359 14 0 |

Copper ores for sale at the Royal Hotel, Truro, on Thursday next—Mines and Parcels.—Devon Great Consols 1615—South Caradon 472—Marke Valley 440—Brookwood 263—Wheal Friendship 202—West Maria and Fortescue 190—East Caradon 181—Gunnislake (Clitters') 180—Virtuous Lady 104—West Caradon 98—Prince of Wales 87—Okel Tor 53—Devon and Cornwall 47.—Total, 3932 tons.

# TANGYE BROTHERS AND HOLMAN,

## 10, LAURENCE POUNTNEY LANE, LONDON,

## CORNWALL WORKS (TANGYE BROTHERS), BIRMINGHAM.

SOLE MAKERS OF

## THE "SPECIAL" STEAM PUMPS.

**Over 1000 in Use.**

IN USE AT

The Black Boy Collieries, Bishop Auckland.

The Westminster Collieries, Wrexham.

The Monkwearmouth Colliery, Sunderland.

The South Benwell Colliery Newcastle-on-Tyne.

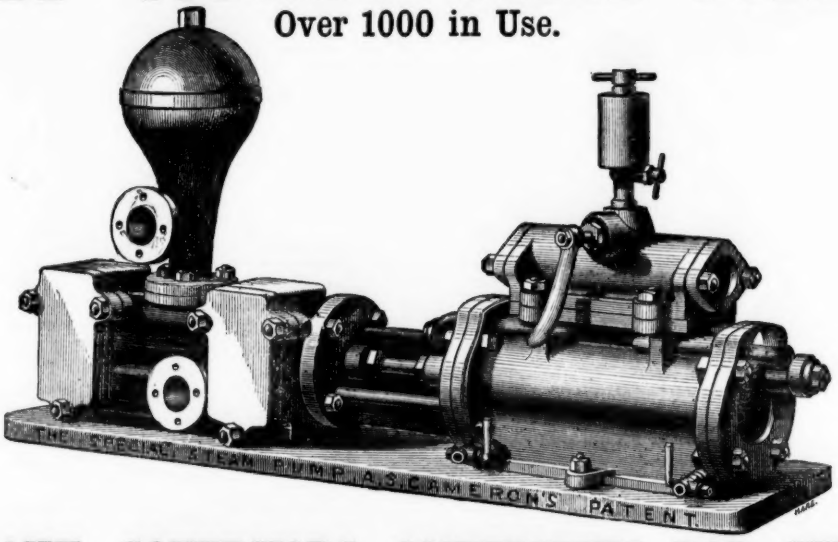
Messrs. Bagnall and Sons Colliery, South Staffordshire.

Acomb Colliery, Hexham.

North Bitchburn Colliery, Durham.

Brancepeth Colliery, Durham, &c., &c.

And numerous others.




NOTE.

Requires NO Shafting, Gearing, Riggers, or Belts.

All Double-Acting:

Works at any Speed, and any Pressure of Steam.

Will Force to any Height.

Delivers a constant stream.

Can be placed any distance away from a Boiler.

Occupies little space.

Simple, Durable, Economical.

## NO FLY-WHEEL, CRANK, GOVERNORS, CONNECTING ROD, GUIDE, OR ECCENTRIC.

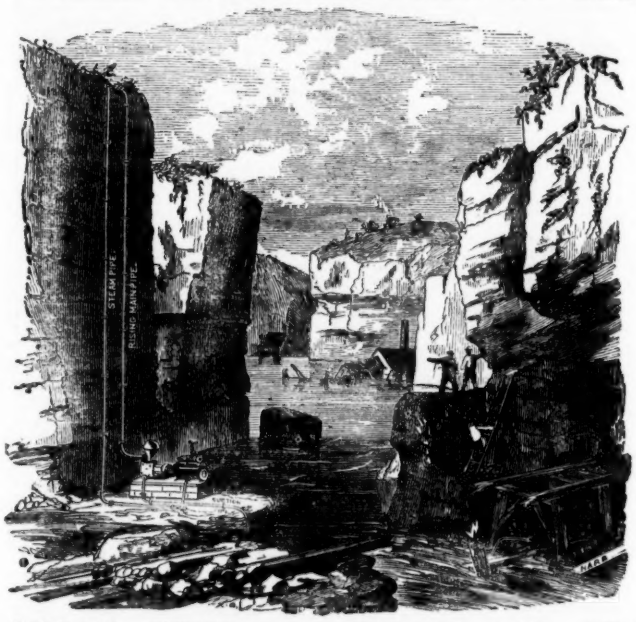
Supplied to H.M.'s Arsenal and Dockyards at Woolwich, Chatham, and Devonport, also for use on board H.M.'s Ships, Hercules and Monarch.

FORTY THOUS ND GALLONS PER HOUR IS BEING RAISED 40 FEET HIGH AT MR. McMURRAY'S PAPER MILL, WANDSWORTH, BY THE "SPECIAL" STEAM PUMP.

## THE "SPECIAL" STEAM PUMP AS APPLIED TO DRAINING QUARRIES.

The engraving illustrates the "SPECIAL" Steam Pump as employed in draining quarries. At the Bangor and Carnarvon Slate Company's Quarries, in Wales, four or five of these pumps, of different dimensions, are at work, as well as at other quarries in various parts of the kingdom.

The pump being fixed in the required position, steam can be supplied by means of a felted steam-pipe from any boiler situated several hundred feet away from the pump; and although a little extra condensation would in such case take place, this system




of draining quarries is found far more economical than employing detached engines and pumps, with their cumbrous details of shafting, gearing, riggers, and belts.

The "SPECIAL" Steam Pump can be adapted to work at either high or low pressure steam, and to discharge the water to a vertical height of from 200 to 400 feet. For very high lifts, pumps with long strokes are recommended.

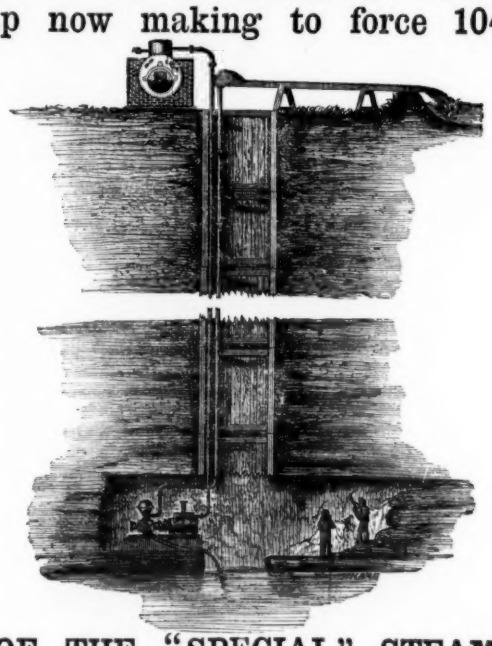
The pump is very portable, and can be readily lowered nearer to the water as the work proceeds.

## THE "SPECIAL" STEAM PUMP AS APPLIED FOR DRAINING MINES.

**One "SPECIAL" Steam Pump now making to force 1040 feet in one direct lift.**

The arrangement in the accompanying illustration shows an economical method of draining mines without the expense of erecting surface-engines, fixing pump-rods, or other gearing. A boiler adjacent to the pit's mouth is all that is necessary on the surface; from thence steam may readily be taken down, by means of a felted steam-pipe, to connect the pump with the boiler. The pump may be placed in any situation that may be convenient for working it, and connecting the steam, suction, and delivery pipes.

These engines can be fixed and set to work in a



comparatively short time, and also at a very small outlay. They are used in large mines as auxiliary engines, and will be found invaluable adjuncts in all mining operations.

To estimate the quantity of water to be raised by any given size of pump refer to the tabulated list below. I is recommended to use long-stroke pumps where the height exceeds 100 ft., so that the largest result may be obtained with a minimum wear and tear of the pump pistons and valves. The pumps are provided with doors for ready access to all working parts.

## PRICES OF THE "SPECIAL" STEAM PUMPS.

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter of Steam Cylinder ..... inches | 2½ | 3 | 4 | 4 | 6 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 10 | 10 | 12 | 12 | 14 | 16 | 24 |
| Diameter of Water Cylinder ..... inches | 1¼ | 1½ | 2 | 4 | 3 | 4 | 6 | 5 | 6 | 7 | 4 | 6 | 7 | 8 | 6 | 7 | 8 | 10 | 12 | 7 | 10 |
| Length of Stroke ..... inches | 6 | 9 | 9 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 18 | 24 | 24 | 24 | 24 |
| Strokes per minute ..... | 100 | 100 | 75 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 35 | — | — | — | — |
| Gallons per hour ..... | 310 | 680 | 910 | 3250 | 1830 | 3250 | 7330 | 5070 | 7330 | 9750 | 3250 | 7330 | 9500 | 13,000 | 7330 | 9500 | 13,000 | — | — | — | — |
| PRICE ..... | £10 | £15 | £20 | £35 | £30 | £40 | £40 10 | £50 | £52 10 | £57 10 | £50 | £55 | £65 | £75 | £70 | £80 | £100 | — | — | — | — |

IF BRASS LINED, OR SOLID BRASS OR GUN-METAL WATER CYLINDERS, WITH COPPER AIR VESSELS, EXTRA, ACCORDING TO SIZE.

Any Combination can be made between the Steam and Water Cylinders, provided the Lengths of Stroke are the same, thus—8 in. Steam and 3 in. Water, or 10 in. Steam and 3 in. Water, adapted to height of lift and pressure of steam, and so on.

## TANGYE BROTHERS & HOLMAN: Offices & Warehouse, 10, Laurence Pountney-lane, London, E.C.

NORTHERN DISTRICT: ALFRED STANSFIELD RAKE, ST. NICHOLAS BUILDINGS, NEWCASTLE-UPON-TYNE.
DEPOT FOR SOUTH WALES: BANK CHAMBERS, NEWPORT, MON.—MESSRS. STEEL, RAKE, & CO.

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